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GAS JOURNAL

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[Founded in 1849 as the "Journal of Gas Lighting."]

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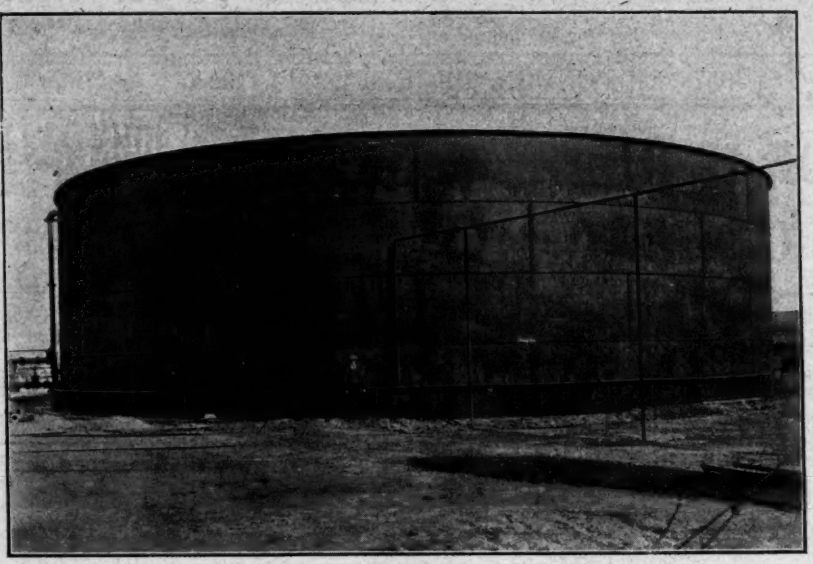

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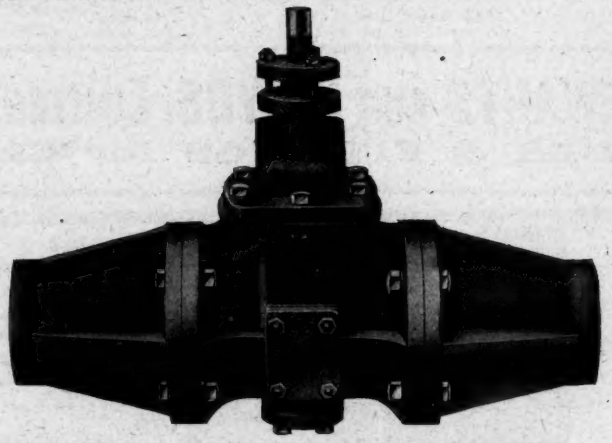

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EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON, E.C. 4.

VOL. CLVI., No. 3057.] WEDNESDAY, DECEMBER 14, 1921. [73RD YEAR.

EDITORIAL NOTES.

The Basic Price and Dividend.

THE question as to whether gas companies can apply to the Board of Trade, under section 10 of the Gas Regulation Act, for conversion from the sliding-scale provisions to the South Metropolitan plan of basic price and dividend, with profit division between consumers, proprietors, and employees when the charge is below the basic price, appears to be still in the balance. It is understood that the point has been raised with the National Gas Council as to whether gas undertakings can proceed through the Board to get the change effected. As a result of the inquiries instituted by the Council, they are informed that the matter has been carefully considered by the President of the Board, who has decided that the Board must wait until the view of Parliament on proposals of this character has been more clearly ascertained before authorizing the change under section 10 of the Act. This is a complete variation of the decision arrived at seven months ago on the Swansea Gas Company's Bill; and as apparently fresh considerations have arisen which prevent the decision then reached being taken as a determinate one, it is time that the question was promptly settled.

The matter was originally raised by us as far back as Nov. 3, 1920. We first asked the Board whether a sliding-scale company could adopt the South Metropolitan plan under section 1 of the Act; and the Board replied in the negative. Thereupon, a correspondent pointed out that by a Provisional Order a Company had hitherto been able to change from maximum price to the sliding-scale and a standard price through the Board of Trade; and that therefore he did not see why application for the change to the South Metropolitan plan could not be made under the Special Orders section of the Act. We submitted the point to the Board; and the reply received was: "I am directed by the "Board of Trade to state that they are disposed to concur "in the view taken by your correspondent." Then we come to the proceedings on the Swansea Gas Bill, before Sir Harry Samuel's Committee. The preliminary view of Sir Harry was that, as revision of the basic price would be in the hands of the Board, they were surely the appropriate authority to fix the basic price. The Committee had a conference with Sir Ernest Moon, K.C., Speaker's Counsel, on the question of whether or not dealing with the basic price should be left to the Board of Trade; and there followed a consultation with a representative of the Board. The result of these deliberations was that the Chairman announced that the Committee had decided to put a clause in the Bill leaving the fixing of the basic price to the Board of Trade. Sir Harry said he was sure they were doing the best thing for all parties concerned. The whole matter was most complicated, and would be very difficult, especially having regard to the very rapid changes that were taking place. We entirely agree with Sir Harry in this expression of opinion. The matter is one with which a Committee of Parliament should not be asked to deal. The Board of Trade has now all the machinery for examining into any application of the kind, and a department that has already become expert in the work.

That is where the matter was left last June, when one was fairly entitled to believe there could be no further controversy over it. Now comes the opinion of the President of the Board, that the view of Parliament should be more clearly ascertained. The time has expired for notices of Bills for next session; and therefore the Board of Trade should as quickly as possible get a positive decision on the subject, in order that gas undertakings who desire to obtain the additional protection of the basic price and dividend with the associated plan for dealing with profits, may not longer be delayed. As we have seen, it is not by any means a new question, having first been raised over twelve months ago. In view of its importance, it is a pity that it has not been finally settled before this.

Irish Free State and the Gas Industry.

THE men of the British gas industry will share with the rest of the world in the gratification over the settlement of the Irish controversy, and trust that now there will be final ratification, so that peace may be restored, the long misunderstandings vanish, the best of the old traditions of Ireland be developed, and new progress be achieved. All this can be said with heartfelt sincerity without evincing any political bias. For it is quite plain Ireland cannot, under the reign of perpetual disturbance and discontent, make the material progress which she should do. Both this country and Ireland will be all the better for working together peacefully, each operating for its own internal well-being, which will bring mutual advantage, for we want from Ireland, and Ireland wants from us. Even the gas undertakings cannot do without this country. They want from it coal, gas plant, and other supplies. What this country does in gas making will to a large extent, conformable with local circumstances, be followed in Ireland. The parts of the industry in the two countries have links which cannot, and will not, be broken—links inherent and personal. With ratification of the agreement, the Irish Free State, and if still separate, the Government of Northern Ireland, will in due course make laws of their own. The general laws affecting the gas industry of Ireland (which have been the same as for this country) will perhaps in time be overhauled. We see no reason why they should be rejected. It would be easy enough to adopt them—discarding that which is obsolete, and causing revision from time to time according to need. But Ireland will, if things go well, have her own common laws, her own Private Bills, and her own methods of regulation and control of statutory concerns. The legislative venue changes from Westminster to Dublin and (providing there is continued separation of north from south) Belfast. Such gas legislative work as did come from Ireland to London in connection with new gas powers will now remain at home. The National Gas Council and the Gas Companies' Protection Association will therefore be useless to the Irish gas undertakings in respect of legislation and departmental conferences and negotiations; but association may continue to be desirable in respect of policy, consultation, and agency, in view of the fact that the business relations of the gas undertakings of Ireland with this country will have to be on the same lines as now, and will possibly, with advancing prosperity, be of larger measure in future than now. Anyway, governmental and territorial boundaries will make no difference to the spirit of fraternity that is found in the relationships of the gas men of Great Britain and what is now proposed to be the Irish Free State. Irish gas engineers will still figure in the ranks of the Institution of Gas Engineers, and at the annual and other conferences will take their places alongside of their British professional colleagues.

Town's Gas and Gas-Engine Makers.

THE question of the use of town's gas for power purposes is one that has fallen somewhat into the rear of matters that are currently receiving technical consideration in the gas industry. This is not owing to the gas-engine business not being as large as ever it was, because the reports and information given from time to time by the gas-engine makers and Sir Dugald Clerk have suggested that the production of engines is on a greater scale than ever, which is proof posi-

tive that the electric motor is not annihilating gas power in our industries. From the economical point of view, it would be impossible for electricity to do this; and, as we have frequently pointed out, the superiority of the one form of power or the other depends absolutely on the conditions of use. The catholic view of the gas industry in this matter has been expressed in these columns time after time; and the industry itself has demonstrated this view by its own action in adopting electricity or gas power variously in its own operations as may be most expedient, having in view the purpose to which the power is to be applied.

In a paper that Mr. Edward Crowther read before the Students' Section of the Liverpool Engineering Society on Thursday last, he gave foremost consideration to certain aspects of the utilization of town's gas in gas-engines. As we have said, the gas-engine is as popular as ever as an economical institution in industry; but there is no doubt that there has been an attempt to divorce to a considerable extent the relationship existing between town's gas and the gas-engine. This we think is traceable to the fact that gas-engines are able to maintain a good efficiency on low-grade gases—such as producer gases—and the manufacturers of gas-engines have consequently developed a new business by supplying as part of the power plant the producer-gas adjuncts, which, of course, means additional revenue. This they were able, and were entitled to do, through the improvements that have been made in gas-engine construction, which have enabled a considerable increase in compression pressures, that, as Mr. Crowther points out, allows a wider range of fuels to be used, and has assisted in greatly improving the efficiency of the engine. This has also enlarged the range of powers produced in a single unit. Though entitled to extend their business through producer gas, it should not have been done to the neglect of their old friend the gas industry, who stood by them in the nascent and developing stages of the engine business. It is hoped the manufacturers of gas-engines will consider the criticism made by Mr. Crowther with the same sincerity as that with which he makes it. He alleges, and it is perfectly true, that in some cases—though not in all—the gas-engine makers have not kept in touch with the practices of the gas industry, and have maintained an attitude that has not been in the best interests of the two industries. This criticism could not possibly apply to Sir Dugald Clerk; he, at all events, stands apart. If considered in the right spirit, and the development of the gas industry is viewed in the proper perspective, the engine makers, we feel certain, will do everything they possibly can to bring about closer relationships with the industry.

How far some of the makers are from having an adequate knowledge of the developments in the gas industry is evidenced by the single fact that, in many instances, so asserts Mr. Crowther, the guarantee given of engine performance figures on a gas of about 600 B.Th.U., whereas the average quality of town's gas through the country is at the present time below 500 B.Th.U.—450 to 480 B.Th.U. being fairly general limits. The effect of this is a disadvantage to the gas industry, and, in fact, a gross injustice, inasmuch as the figures supplied as to probable consumption, calculating on a thermal concentration of 600 B.Th.U. per cubic foot, are too low by perhaps (as the author says) some 20 p.ct.; and, moreover, the overload capacity may also be slightly reduced, with the result that the user becomes dissatisfied. In view of what is now taking place in the gas industry under the new legislation, no gas-engine from the present time should be sent out with the probable consumption expressed in cubic feet. Seeing that gas is to be sold in future on the therm basis, the makers could give more definite guarantees (which would apply to a considerable range of calorific values) based on the therms used, even without knowing the destination of any particular engine, which is not the case under the rule of cubic feet. This would be an advantage to the makers as well as to the gas industry, and would enable the power user to know more definitely what would be his expenditure of fuel, and thus avoid dissatisfaction with both the type of engine he has adopted and the local gas supply. This is a point to which we hope the engine makers will pay heed; but the fact that there are engines being sent out to-day with their consumption per horse power based on 600 B.Th.U. town's gas, is an indication of the detachment of some makers from the technical developments in the gas industry. Another criticism which shows that some of the makers have little appreciation of the divergent qualities of gases in different gas-supply areas is where Mr. Crowther points out that a firm was within recent years actually turning-out a class of gas-engines for town gas without any regulator on the air-supply pipe!

Short-sighted policy is also shown by the apparent unwillingness of manufacturers to do anything more than co-operate with the gas industry in selling their engines, while the co-operation should be carried on to consumers' premises, in order that the reputation of gas power in industry is maintained and even advanced. Such co-operation would be good business policy; but from the side of the manufacturers, there is very little evidence of any desire to foster it. Much business must, in consequence of this lack of enterprise, be lost to both industries, whereas, if interest were shown, instead of there being loss, there would or should be development. Of course, in the case of large gas undertakings whose power business is sufficiently extensive for them to afford to keep an expert to inspect and adjust the gas-engines on their district, the co-operation here suggested would perhaps not be so necessary as in the case of those smaller districts where engines are in use, but not in such number as to justify the employment of a qualified man periodically to inspect and readjust them. It is here particularly that the co-operative interest of the gas-engine makers should be found; and even in the larger districts where gas-engines abound, some form of alliance with the manufacturers in maintaining the working efficiency of the engines would be of considerable mutual advantage. We well remember how, not a great many years ago, a systematic expert inspection and overhauling of the gas-engines was made in one of the districts of South London; and it was remarkable what a number of the engines required readjustment—to the benefit of the users, as well as of the gas undertaking concerned. This inspection, and the results that followed it, gave an immense amount of satisfaction to those who were employing gas power.

The indifference of the engine makers as to what happens to many of their mechanical progeny after installation is one cause of the success of the electric motor. It is high time that a new policy was adopted by them. Mr. Crowther exposes some of the fictions and extravagances that have been assiduously cultivated and circulated by electric-motor salesmen, and which ascribe to this form of power virtues that are non-existent in excess of those possessed by the gas-engine, and particularly the virtue of economy, which those engaged in industry become aware by experience is a pretty little piece of trade-promoting fallacy. According to Sir Dugald Clerk, where industrial gas can be supplied at 4d. per therm, the gas cost per brake-horse-power will be 0·4d., while with electricity at 1d. per unit the cost for energy per brake-horse-power is 0·83d. Sir Dugald's figure of 10,000 B.Th.U. per brake-horse-power is a liberal one, and can be taken as being an outside one in any circumstances. A considerable part of the paper is devoted to the subject of gas composition in relation to power; but the general result is to show those who have not previously studied the matter that, while the composition of gas has but little effect upon the power output of an engine, it makes its influence felt in other directions of secondary importance. For instance, the time occupied in attaining maximum pressure is considerably affected by the nature of the gas mixture, irrespective of the calorific power of the fuel. The fact that composition is a matter of so little importance in respect of engine operation is a consideration of no mean value to the gas industry in the work that is now proceeding to cheapen the therm. Viewing the position from his practical standpoint, Mr. Crowther says "it may confidently be stated that the future of the town's "gas engine has never been more promising than it is "to-day." This is a belief shared by many. Gas-engine manufacturers should pay heed to the existence of this belief, and work (for mutual business development and protection) in closer alliance with the gas industry than has been the case for some years past.

The Therm Basis Through American Glasses.

OUR good friend from America who spoke at the annual meeting of the Institution of Gas Engineers on the last day—Mr. A. I. Phillips—has presented to the American Gas Association a report on his investigation in this country into the therm unit of charging and kindred matters. The report was printed in the "JOURNAL" last week [p. 682]. It is useful to have the opinions of disinterested observers on an innovation of this kind; but, at the same time, it has to be remembered that our visitor came to this country satu-

rated with the conditions existing in America, and naturally he viewed the change very much from the standpoint of these conditions. So far as he did this, whatever his deductions, these may not, and in fact do not, apply to this country. One of the first things observed is that Mr. Phillips discovered there were wide differences of opinion as to the desirability of the new departure. That may be perfectly true. But never has a change of such magnitude been made in any system without wide differences of opinion have obtained. There were greater differences of opinion in existence when gas was first introduced for the purpose of taking the place of oil and candles for lighting. But it will be appreciated by our American friends that, though there may be wide differences of opinion, the major weight of opinion may be in favour. This Mr. Phillips was unable to judge from what must have been a more or less scattered spot investigation. Naturally no one during a few weeks' stay in the country could make a complete investigation. That the differences of opinion he discovered are not founded on experience, but completely on surmise, is seen by the statement that "it is too soon to predict whether the new "method will prove successful." Was the old method successful, and genuinely sound? The fact that it has been substituted by another system is sufficient answer. What was found was that the per 1000 cubic feet method gave considerable scope for variable qualities of gas in the same supply area, to the detriment of use by consumers. And there was no really reliable basis on which consumers, and even gas people, could institute comparison as to the value that was being given and received as between one supply district and another. The sale per 100,000 B.Th.U. gives a very definite basis of comparison, which we believe will in itself be valuable, and, moreover, will be an incentive to the production of gas which will have better constancy in composition and quality than before, that will be produced as economically as possible, and that will be as free from incombustibles as reasonable control will permit.

There seems to be a notion abroad that municipal authorities are not very keen about the price basis change. Perhaps some of them are not. Admittedly in their case there is lacking the same amount of necessity for price revision as exists in the case of companies. There are some concerns with their feet deeply embedded in an aggregate of tradition and custom, and the administrators of which have difficulty in seeing any substantial benefit in change of any kind. But Mr. Phillips's exploration did not take in many of the municipal undertakings. There are in this country 311 local authorities supplying gas under statutory powers; and though the five municipal concerns that were visited by the investigator were large ones—five do not represent a large percentage of the whole—there is not one of them that is of the magnitude of the Gas Light and Coke Company or the South Metropolitan Gas Company, the last named of which has had fourteen months' experience of the therm system, without worry to the Company or to the consumers. Naturally, there have been questions asked by consumers, but satisfaction has been given. The first-named Company, too, has been operating under the system now for nearly nine months; and matters have gone on in quite normal fashion. There has been no upheaval and no public agitation. One of the corporations referred to by Mr. Phillips, he says, promoted a Bill last session, which has recently been passed, containing a fixed standard of 450 B.Th.U., and with no provision for charging by the therm. We fancy that Mr. Phillips is referring to the Manchester Corporation; but it will interest him to know that in all cases in the past session of Parliament—Manchester included—in which price revision was allowed to local authorities on the 1000 c.ft. basis, provision was inserted compelling the authorities to apply within a year to the Board of Trade for conversion to the therm basis of the maximum price allowed. As to the point that the accounting costs would be increased as much as 10 p.ct., Mr. W. E. Caton, of Oxford, in his Midland Association paper [*ante* p. 561], remarked that, "so far as office work "in our case is concerned, less writing on the consumers' "accounts practically counterbalances the additional work "involved on the ledgers, although there is an extra calcu-"lation to make."

It is found by Mr. Phillips that the power given to each gas undertaking to declare the calorific value which is most compatible with its economic conditions is much appreciated; and he thinks this change is an advance. This and the charge per therm are two things that are bound-up together; but the fact is frequently overlooked. Whatever differences, wide or narrow, there may be between the calorific power declarations of gas undertakings, these are brought to a common basis again in the therm. There is value in this—both technical and commercial. The liberty of declaration opens to the view of Mr. Phillips much advantage in plant development from horizontal and vertical retorts with steaming, water-gas production, to complete gasification. He sees, too, the educational benefit that has accrued to the gas industry by being taken out of the even tenour of its way during the war and since, and forced into the region of low calorific power gas through the perplexities and complexities arising from the situation. He has been where 400 to 425 B.Th.U. gas is distributed. He has found satisfaction, and no blackened mantles. These things strike him—coming from America where unhappy experiences are known through the gas being rich in hydrocarbons. He failed, however, to find any definite data showing the effect upon the consumer of the reduction in calorific value. If there has been any effect at all, it has been of a modest character even on the cubic feet basis. But with charges on the heat-unit basis, future changes in the heat concentration per cubic foot will not produce, so investigation informs us (given proper adjustment), any effect on the consumption of therms for equal work. As a matter of fact, the less air required for complete combustion per cubic foot with the lower-grade gas, the better the admixture, and the efficiency is somewhat improved.

However, while Mr. Phillips approves the declaration of calorific power by each undertaking according to economic conditions, he does not explain how standard or maximum prices can be better fixed than on the heat-unit basis if the liberty is to obtain which allows the declared calorific power to be varied as conditions permit. He does not think the therm price of charging would be popular in America, in view of the radical differences between American and British conditions; nor does he believe the public would welcome the change. No one can tell what would happen in America if the change was made; no one could tell here. But the vision of insuperable trouble has faded-away in practice where the system has been applied.

At the Gas Sales End.

A WEEK ago, in discussing the valuable paper which Mr. W. J. Sandeman, of Croydon, read before the Southern District Association of Gas Engineers and Managers, we pointed out that some of our most observant authorities in the gas industry were deeply impressed by the fact that, taking the industry through and through, there was a lack in many places of scientific or rational organization and dealing at the sales end of the gas business, and an absence in many places of properly trained and qualified men for the work. We see signs of a rising tide of enthusiasm for, and concentration upon, this work. And it is welcomed; for in our view, so vital is the trading end to the progress of the gas industry that we place it on an equality with the producing end. The inter-relation between the two is noteworthy. The larger the sales of gas, the greater the economy with which operations at the producing end can be carried on. The greater the efficiency at the producing end, and the cheaper the therm can be sold, the better for the gas sales end—given a broad policy and proper organization. And as Mr. J. H. Clegg, of Burnley, intimates in the paper that he read last week before the Manchester District Junior Association, good value and economy from the producing end can be destroyed by bad service and inefficiency at the sales end. The paper by Mr. Clegg and one by Mr. Archibald Wylie, of Glasgow, before the Scottish Junior Association (Western District), come opportunely after the paper by Mr. Sandeman. They reflect the fresh interest that is being taken in the subject of gas trading; they indicate a definite movement to raise the standards of efficient policy and method in the business. We hope this work will go on—everywhere, and without delay. Trading policy, organization, and method are not compassed by the establishment of a showroom, necessary as it is as a centre of exhibition and demonstration, but they go much beyond that—right away indeed to the points of gas use. The best possible surveillance should not cease until these points are reached. Mr. Clegg is strong on suitable advertising, which he specifies as (1) efficient service, (2) central showrooms, (3) B.C.G.A. He says nothing about the local Press. The local Press should be cultivated, though admittedly its

influence in business-getting is not so great as the efficient service which makes people testify to satisfaction and to receiving good value for money.

This is especially the case with good conditioned gas-fires, the comfort of which is best afforded when atmospheric severities are the keenest. The prejudice against gas-fires, excepting perhaps among a few old-fashioned people who had experience years ago of old-fashioned gas-fires, has been killed by the modern types; and even a bigger success would have already been achieved if there had not been such a diversity of experience in respect of cleaning and adjustment. We have experience of consumers' gas-fires in half-a-dozen different districts; and it is (to say the least) remarkable what a divergence of practice there is in the amount of attention that is given in these various gas-supply areas to the maintenance and adjustment of the fires. Some fires are never visited by a man from the gas suppliers; and so the burners get choked, the radiants dilapidated, and the user dissatisfied. Yet gas-fires are such good consumers, and, with proper attention, excellent advertisers. Gas-fires are more popular to-day than ever; but the rate of upward movement of popularity will only be maintained and increased by vigilance and attention. The narrow view in this matter is a danger. We know of gas men who cannot see that anything should be done that does not *per se* pay for itself. They lose sight of the objective, which is increased stabilization and extension of the gas business. In taking a broad view, we would make fittings and installation work a paying branch of the business without directly seeking profits. On rendering good service we should not at all object to ½d. or so per therm being devoted to it; and the lower the cost per therm could be brought, the larger should be the contribution to good service. Everything that is, or can be, done should be for the benefit of the gas business; and the more that is done in this direction, the less work will the complaints department have to perform.

We see that Mr. Wylie unites the complaints and inquiries work. It is a good association. The method adopted at Glasgow ensures that complaints are not neglected. Complaints should not, as Mr. Goodenough emphasized in the Southern Association discussion reported last week, be regarded as nuisances, but rather as opportunities for doing one of the things that Mr. Wylie and all progressive gas salesmen regard as important—that is, to increase the consumption of existing customers. It is an advantage to get (even through complaints) into closer touch with the consumers; but the advertising value of unalloyed satisfaction ranks highest in importance.

Gas-Coal Position.

From all the coalfields, except Durham and Northumberland, there come reports that the demand for gas coal is in quite good volume—the tendency being to increase stocks, in view of the approaching holidays. The fogs and cold weather of recent times have also had an inspiriting influence upon the views of gas managers as to the amounts of their stocks. It is generally reported that supplies are equal to the demand, but there has been so much buying in the open market, combined with the extra seasonal quantities required, that there is a tendency for open-market prices to harden. This applies more to the Yorkshire and Midland areas, than to Durham and Northumberland, in which fields there is still dissatisfaction with the gas-coal position. In those areas, the prices for gas-coal varieties are distinctly more tempting than they were not many weeks since.

Railway Rates for Coal.

The Mining Association are receiving a large amount of support from the industries generally, including the gas industry, in their action for securing a reduction of railway rates for coal. Such support of the prime movers will probably help the railway companies to arrive at the desired conclusion.

Recording Calorimeters.

The reply of Prof. Cobb and Mr. James W. Wood to the discussion on the fifth report of the Gas Investigation Committee is published this week. The importance of the subject, in view of the enactment in the Gas Regulation Act which prescribes the use of recording calorimeters in the future business of the gas industry, cannot be over-rated; and therefore Prof. Cobb and Mr. Wood desire that the report shall be taken as a critical study in the science of gas calorimetry rather than of a particular instrument.

Silica Bricks.

The President of the Cleveland Institution of Engineers recently suggested that the quality of silica bricks in this country is not so good as before the war. In the "Iron and Coal Trades Review," one important firm of manufacturers contests the truth of this as applying to the makers generally. There are silica bricks and silica bricks. Their variety is as great as the qualities of the coal and coke on the market to-day. Naturally therefore anything approaching wholesale condemnation is very disappointing to those manufacturers who have been seriously endeavouring to produce better and better bricks. Some makers have been compelled partly to substitute for true ganister a silica rock which, while equally high in silica, is different in mechanical properties, and requires different heat treatment to give the best results. It may be that this point has not had sufficient consideration by some of the makers, and that they are treating their bricks in the same way as before. To produce a really superior silica brick means burning it at a high temperature, and for a long period. This, of course, is a more costly process; but the additional price to the user pays in the long run.

Deposits in Steel Pipes.

The paper regarding deposits in steel pipes that Mr. James J. Scott, the Engineer of the Cowdenbeath Gas-Works, read to the members of the Eastern District of the Scottish Junior Gas Association, on the occasion of their visit to his works last week, is a valuable contribution to a subject which has not yet been wholly satisfactorily solved. Messrs. Taplay and Parkinson have done a great deal of work in this respect in connection with the Life of Gas-Meters Research Committee. They have traced the deposits in mains to corrosive constituents in the gas; but the explanation, having regard to the characteristics of the deposits, is not yet altogether complete or conclusive. This is seen by the various analyses of deposits which Mr. Scott gives in his paper; and it is in the fulness of the particulars that he supplies as to his experiences and the nature of the deposits that the interest of his paper lies. There is something rather mystifying about this matter. All that can be said is that the deposits must be the work of a combination of causes in which oxygen and cyanogen play a principal part. Messrs. Taplay and Parkinson, in correspondence with Mr. Scott, expressed the opinion that hydrocyanic acid is the cause of the corrosion. But corrosion does not account for the whole of the constitution of the deposits, though corrosive deposits (through subsequent scrubbing of, and chemical action with, the gas) may be the initial and promoting cause of the composition. Mr. Scott makes the point that in the section of his canalization in which the interior of the pipes is protected by oil, there has been no trouble. Oil-spraying of gas, however, is only a palliative; and in a system in which there are deposits such as are described, the oil might well cause these deposits to become more troublesome. The problem of how to get rid of the deposits is a difficult one. But apart from their removal, while oil treatment of the gas is a protective advantage to the distribution system, the extraction at the works of pernicious constituents of the gas is what should be aimed at. Thus it is that Mr. Scott looks with hope to the working-scale experiments at the works of the Gas Light and Coke Company giving a simple method for relieving the gas of that vicious compound, hydrocyanic acid.

Not this Time.

Our old friend Mr. J. Wesley Whimster is a Scotsman, and the President of the Southern Association of Gas Engineers. He has read the paragraph in last week's "JOURNAL" on "The Scotsmen Win," which showed that in eight years the chair of the Association will have been (including 1922) occupied by gentlemen five of whom are Scotsmen. The paragraph last week ended with the words "The Scotsmen show superiority—numerically." On reading this Mr. Whimster put his hand in his pocket and spent a shilling, which brought to us a telegram: "Why numerically only.—Whimster, Bath." The "only" is Mr. Whimster's addendum. We did not use it. There is caution down south as well as up north. Had we gone into details beyond the word "numerically," we should have soon learned much as to the meanings attached to such phrases as "Invidious comparisons," and "Comparisons are odious." And so the pen stopped at "numerically." Consideration had to be given to the feelings of three Englishmen as well as to those of five Scotsmen.

PERSONAL.

Mr. F. H. VINCE, of the Saltley Gas-Works, Birmingham, has been appointed to the position of Resident Works Superintendent of the Redheugh Gas-Works of the Newcastle-upon-Tyne and Gateshead Gas Company.

Mr. DARYL J. BRANSON, Manager to the Pontefract Corporation Gas Department for the past six years, and son of Dr. W. Mitchell Branson, of Halifax, has been appointed Engineer and Manager to the Faversham Gas Company, at a commencing salary of £500 per annum, with coal and gas.

OBITUARY.

Mr. ARCHIBALD DOUGALL died at Kidderminster on Tuesday last week, while proceeding home from business. He was appointed in 1874 Manager of the Kidderminster Gas Company, and was in his 73rd year. He leaves a widow, two sons, and a daughter. Mr. Dougall was trained as a gas engineer with Messrs. Hanna, Donald, and Wilson, of Paisley, and later was Manager of the Elgin Gas-Works. On Nov. 5, 1874, he succeeded his brother, Mr. Andrew Dougall, as Manager at Kidderminster, which position he held until 1913, when he was appointed Consulting Engineer and Secretary; the duties of Manager being taken over by his son, Mr. Percy Dougall. Kidderminster was one of the pioneer towns in England to instal gas lighting, and the centenary of the Company was celebrated in 1918.

ELECTRICITY SUPPLY MEMORANDA.

THE recent low atmospheric temperatures have caused a renewed rush for gas-fires. The increased use of gas for heating has no terrors for the gas manager. His storage enables him to tide-over sudden and capricious demands; and water-gas and complete gasification plants, which can be brought into commission without delay, give him not only a sense of, but actual, security, and an ability to meet all demands consistent with the capacity of his mains, the carrying power of which can be increased by raising the pressure. His position is a happy one compared with that of the electrical engineer, who has limitations which are inflexible. The electricians have been boasting much of their heating load. But, truth to tell, it is of rather a liliputian order compared with gas heating; and the cost of the heating value supplied is something that sends a very nasty chill down the backs of users of such appliances. "Electrical Industries," in a short article on the "Cold Snap Peak," refers to the electric radiators connected-up to the cables of an electricity undertaking as "so many" that, when the temperature falls very low, the load "may" rise quickly to unexampled heights. Judging from what happens in the case of the gas-heating load, the "may" should be "will." If the load does not at such a time rise—we will not say to "unexampled heights," but to peak heights, then the inference is that the householders do not think much of such heaters at a period when they are most called for, and that they find other methods of heating more appropriate. This does not accord with a little piece of extravagance towards the end of the article, where it is positively stated that, as the air gets colder and colder, the "world and his wife simultaneously shiver, and rush to the most convenient source of immediate heat—the electric fire." That is rich. It omits an explanation of how it is that at such periods there are tremendous drafts on gasholders, and more gas-manufacturing plant has to be requisitioned. However, the electrical engineer is warned by our contemporary that "when the number of electric heaters on circuit has multiplied (as it assuredly will), the engineer will be forced to take precautions against such embarrassing compliments to his power of generating unlimited quantities of electricity at a moment's notice." Apparently, the heating business for electricity concerns, even so far as it increases, is going to cause the electrical engineer some uncomfortable periods, and will disturb his equanimity in the period of the year when the lighting demands are the greatest. Cold "snaps" are now sometimes of long duration, and do not cease with the failure of daylight. In residential districts, the plant that would have to be kept going to meet the heating demand during lighting hours would simply be eating its head off during perhaps eight or nine months of the year.

Electric Heaters and Cold Snaps.

Free Wiring.

The "Electrical Times" continues to collect opinions regarding this subject, which, it will be remembered, was revived by Mr. G. H. Nisbett. Generally speaking, the idea is being looked at dubiously. The additional obligation is not liked—prices are high, and paying custom in the smaller houses is extremely questionable. It is well to know what the general opinion is regarding a matter of policy of this kind. It is also well to know what sort of experience people have had who have indulged in the system. Mr. Sydney E. Day, the Borough of Bury St. Edmunds Electrical Engineer, is one of these. He instals free wiring, limiting the number of lights to four. These are fixed in rooms selected by the Borough Electrical Engineer, where they will be of permanent utility—one light per room being the rule. The wiring contractors canvass and compete for the work; and when once the light is installed, the consumer can make extensions at his own expense. Current is supplied at 1d. per unit above the ordinary price. This is interesting. It adds another complication to electricity trading methods. How does Mr. Day allocate the consumption on the consumer's own extensions, and that on the "free" wiring, which has to pay an additional 1d. per unit? The system is considered by Mr. Day to have been an undoubted success. Other engineers are averse to municipal work in this connection, and think that whatever is done in this way should be undertaken by the contractors. Mr. C. G. Nobbs, the Governing Director of George Nobbs, Ltd., is favourable to free wiring, and not only for lighting points, but for domestic heating and power. Circuits should be run-in to give the consumers the option of using them with "at least the same freedom as poisonous gas inlets." Mr. Nobbs is not complimentary, but, in our opinion, he is foolish in this peevish slap at popular gas. We have heard of voltages of 240 and less ending the careers of not a few persons. The experience of Mr. W. Fennell, when he was at Wednesbury, is that he found it wise after a time to limit free wiring to houses not occupied by their owners, and to a certain number of points—five he thinks. In those days wiring could be carried out at 9s. to 10s. per point; but there is hesitancy on his part (he is now at Northwich) to recommend the system with points costing 30s. to 40s. each. He is hopeful that, with high gas charges and a reduction of electrical installation costs, he will soon be able to look at the position from a different angle. But gas charges will recede from the present heights. He seems, however, to have an inclination for trying the scheme at Northwich, when installation costs per point reach £1.

The Path of Least Resistance.

Despite the efforts of the Electrical Development Association to maintain a fictitious optimism, and those of the enthusiasts for complete domestic electrification, quite a considerable number of men in the electricity industry have resigned themselves to the belief that the costs of the larger appliances and of installation, and the expenses of the heat energy of electricity, are very genuine obstacles to the realization of the ambitions that once possessed them. Apparently the contributor of "Cooking and Heating Notes" in the "Electrical Times" has reluctantly come to this conclusion. He is now advising, as many others have done, that the development of the use of electric apparatus will be best accomplished by pushing the sale of small accessory appliances such as irons, kettles, grills, and so forth. At the same time, he says something which is obviously so perfectly proper that no one will be prepared to dispute it. "Where a householder," he remarks, "can be persuaded to go in for a complete electric cooking range, this should undoubtedly be installed." It seems a superfluity to have said this. If there is any electric salesman who would refuse to supply a customer who wanted a complete electric range, he would be kicked out of his job for being an idiot. One has never yet met an electrical salesman who is so animated by philanthropic motives that he would say to a would-be purchaser of a range: "Pray don't, because I cannot guarantee its reliability, and you may be so disappointed over the expense and the slowness of the operations, that the adoption of it by you would cause me grief." However, the writer in our contemporary admits that the relatively high initial cost, including wiring and sundry expenses, compared with alternative methods of cooking, proves prohibitive in many cases. His view is that confidence will come with the introduction of small electric appliances. Complete electrification, he holds, is the object to be aimed at; but to secure it, the line of least resistance will be through the small appliances.

The Limitations of Electricity.

All this indicates one side of the limits of electricity in meeting the heat requirements of the general public for cooking purposes. Further limits are found in the ineffectual capacity without enormous cost of electric-heaters for continuous use in the depth of winter. Additional limits are seen in the application of electricity to small property for lighting, in which the consumption with present-day lamps is not sufficient in numerous cases to provide the necessary profits to pay the capital charges involved by the undertaking giving the supply. And penetrating still further, the potential heat energy in a unit of electricity is only 3420 B.Th.U. The electricity industry should realize its limitations, and not adversely affect the financial conditions of its undertakings by refusing recognition, and by pushing its way into unremunerative business. There is stupidity in the policy of being blind to the salient facts in one's position.

Lead-Covered Cables.

There has been some correspondence in the "Electrical Review" on the subject of the durability of lead-covered cables. One correspondent, writing from Torquay, refers to a lead-covered cable that had been in use fourteen years. A large part of this cable, without any protection, had been run at a depth of 4 ft. through the ordinary soil of the garden. On being taken out, it was found in perfect condition. We have had no experience of lead-covered electric cables, but we have had of a lead water-pipe running from the street main through a fairly long garden to

a house. Through defective supply, it was opened-up and examined. It was found perforated in an extraordinary fashion. The line of pipe crossed the cables of the local electricity suppliers, and the perforations were ascribed to electrolytic action. The pipe otherwise was laid in virgin soil, and not made-up ground. Even with lead pipes or lead-covered cables, care must be taken as to the character of the surrounding soil, particularly made-up soil, on account of its chemical characteristics, which may be very inimical to the pipes or cables.

Housing Schemes and Lighting.

In a paper that Mr. S. J. Watson read at the Public Works, Roads, and Transport Congress, he stated that, from information collected from 84 towns, 41,663 dwellings under housing schemes are or will be electrically lighted; and it is computed that these houses will use an aggregate of 4,334,187 units per annum, or an average of 104 units per house. This is not the average consumption from actual use. It is only estimated. There is no definite knowledge that the average will be 104 units. In fact, since the paper was written, Mr. Watson has had additional replies to his inquiries; and from them he finds the average is 78 units, which reduction makes the supply as a business proposition far worse. People living in such houses are in these days strict economists in the matter of lighting, unless their honesty is put to the test by there not being any meter installed for the protection of the suppliers. But Mr. Watson says that even with an average of 104 units, it is questionable whether such a low consumption affords sufficient revenue to cover the cost in view of the heavy expense involved in providing underground mains and services. The 78 units will be worse. As that figure is an average, the good consumers will be contributing towards the costs of the poor ones.

Electric Power on Gas-Works.

In the same paper, it is remarked that gas-works show a tendency to make fuller use of electric-motors. There is nothing remarkable about this. It simply means that gas-works are going in more extensively for mechanical operation in and about their retort-houses. Their requirements are for the propelling of machinery along the tracks on retort-house floors, for charging and discharging the retorts, for telphers, and for intermittently running coal and coke handling machinery. There is nothing to beat electrical operation for these purposes. But, *per contra*, given long constant runs and loads, there is nothing to beat gas-engines. In fact, in most gas-works electricity generation is by private plants—gas-driven. The intermittent character of the work for which the electric-motors are used is shown by a comparison of the figures that Mr. Watson gives. He states that in 33 gas-works owned by municipalities there are 296 motors, with an aggregate of 4620 H.P.; and the total annual consumption of energy is 1,918.525 units. This represents a consumption of 415 units per horse power per annum, or 6481 units per motor. In the tabulated statement, the nearest approach in horse power to the gas-works figure is for towns' yards, &c.—viz., 4365 H.P. In this case, the consumption is 2,653,901 units, or 608 units per horse power per annum, as against the 415 units in gas-works. There are in the towns' yards 347 motors, and their consumption is 7648 units per motor per annum, as against 6481 units per motor in gas-works. In the sewage departments, the consumption is 773 units per horse power; while in water departments the consumption averages 1491 units per horse power. The units per horse power are therefore the lowest in gas-works, which indicates the specially suitable character of the operations for electricity. It is seen from these figures that the running of the motors in gas-works is of quite an intermittent character.

Shall Germany Construct the Super-Power Stations?

This is an unkind question. The "Electrical Review" is filled with righteous indignation over it. Before the war the British electrical engineering industry was threatened by "Teutonic competition and scheming policies of penetration." The British electrical engineering industry appeared oblivious of the fact then—at any rate, it went on unheeding the danger that was at its very doors. Now Sir Peter Rylands, formerly President of the Federation of British Industries, has suggested that Germany should construct the electric super-power stations that it is thought this country requires. The primary idea is, we take it, that by this means the country would get a bit of its own money back; and the secondary idea is that, being constructed "free" of capital cost, industry would get a cheaper and more abundant supply of electricity, and so the cost of our manufactured products would be lowered. This is a pretty illusion. What the country wants is hard cash from Germany to go and relieve those who had to pay for the war, and those who had to pay so much are not alone the electrical industry, nor the users of electrical power. Some of them happen to be gas undertakings, gas shareholders, and gas power users. Moreover, we have British electrical engineering works employing British labour, and these works and their men, and all the home industries from which they draw supplies, want the contracts for constructing super-power stations when the time comes for their erection and equipment. Sir Peter Rylands on this occasion left the platform of common sense, and somehow made a mess of things.

RECORDING CALORIMETERS.

By Prof. COBB and Mr. J. W. WOOD.

Reply to the Discussion on the Fifth Report of the Gas Investigation Committee, presented at the Annual Meeting of the Institution of Gas Engineers.

It was particularly fitting that the discussion of this report should have been opened by Mr. Simmance. As coming from one who has recognized, and overcome, many of the difficulties and pitfalls of recording calorimetry, his remarks acquire special importance; and his generous appreciation of the work done is highly valued. At the outset, the Research Sub-Committee wish to make it quite clear—if this has not already been done with sufficient emphasis—that they appreciate thoroughly the services of Mr. Simmance in the development of scientific instruments for use in the gas industry, and particularly the "Total Heat Recorder." Many points in its design have plainly been considered with great care, and striking ingenuity has been displayed in its construction—in fact, after careful analysis of the performance of the recorder, it is believed that it comes near the limit of what is possible in practice, while retaining the same principles of operation. It is an essential point in Mr. Simmance's remarks that the recorder was originally designed for works' control. If the instrument is installed on a works, it will be frequently inspected and the fullest use will be made of the non-recording portion of the apparatus for correcting (if necessary) the chart at reasonable intervals; and, as we have endeavoured to show, in such circumstances the recorder is capable of giving most valuable information and assistance to the engineer.

It is unnecessary to enter again into detail as to how the Simmance total heat recorder became a subject of our investigation; but it may be emphasized again that the requirements of the recording proposed under the Gas Regulation Act are very different from those of works' control. It is proposed to obtain for the purposes of the Act a continuous record of calorific value, and to reduce the amount of personal testing required—a test in person once a fortnight being suggested as sufficient for a 100-million works. Since it may be necessary to take action upon the record, reliability without attention over considerable periods is apparently a *sine quâ non*; and consideration of this point has greatly influenced both our methods of testing and the form in which the results have been presented, although we have attempted throughout to give our work permanent value as a study in the science of gas calorimetry, apart from a particular instrument or Act of Parliament—a feature which has plainly appealed to Mr. Simmance, and of which we were very glad to see his ready recognition and mention. Our tests have been necessarily exacting, but not, we believe, too severe when the making of records under the Gas Regulation Act was in question. The remarks of Mr. Simmance as to the legal aspect of recording calorimetry are well worth attention. He apparently considers that there has been some unfairness in our treatment of his gravity governor with respect to gases of widely differing densities, submitting that the governor was adjusted for London gas, and might prove less accurate on other grades. In point of fact, the gas used for the greater number of tests was very similar to that supplied by the Gas Light and Coke Company of London, and, further, very exhaustive tests were made and given in the report, showing that the balance of the governor was reasonably accurate for the gas in question. Had it been otherwise, the makers would certainly have been consulted, and given an opportunity to rectify matters before going further with the tests.

As pointed out by Mr. Blackie later in the discussion, the governing for temperature and pressure changes with the heavier gases can be materially improved if the governor is specially adjusted to deal with only a limited range of the higher densities—*e.g.*, in those cases where an undertaking is permanently supplying a somewhat heavy gas. The report, however, deals with a governor assumed to be set in a normal manner with a gas whose specific gravity is not far removed from ·5. Mr. Simmance adduced that he has observed his governor to behave perfectly when the specific gravity of the gas has changed from ·4 to ·67. Figures are given in our report showing excellent governing over an even wider range of specific gravity when atmospheric temperature and pressure have been favourable; but on occasion different temperature and pressure conditions would cause the governing to be much less accurate. [We are not sure when Mr. Simmance speaks of a "2 p.ct. limit" whether he means ± 1 p.ct. or ±2 p.ct.] Too much stress is laid on the fact that the instrument tested by the Committee does not now represent the latest construction. Since the report was drafted in May last, the recorder we used has been returned to the makers and brought up to date. The water system has been vastly improved; but in other respects the essential features of construction and operation of the recorder are unaltered, and the report already presented would require but minor alterations to cover the behaviour of this later type of instrument. [See also Appendix II. to the report].

Several speakers, including Mr. Simmance, agree that the maintenance of a perfectly uniform water-flow for long periods is an extremely difficult matter—one of the most difficult in connection with calorimetry. Mr. J. P. Leather (Burnley) will find that his suggestion of circulating distilled water has been dealt with in the report. It is mainly a question as to how far we may com-

plicate the testing equipment—bearing in mind that it may have to run without attention—without its becoming impracticable either on the score of cost or unreliability. Experiences at Burnley seem to confirm the difficulties encountered at Birmingham with certain classes of water supplies.

The criticism of Mr. Blackie (of the Fuel Research Board) is valuable, representing as it does an independent investigation of an almost identical instrument. In the main, our experiences with the instrument have been very similar. The essential difference in the two investigations lies in the fact that we have treated the apparatus analytically, taking each part of the apparatus in turn and investigating the individual errors, bearing in mind that at some times these individual errors might neutralize one another, leaving the record unaffected, while at others they would act in the same direction. This course has enabled us to express an opinion as to where the chief errors are located, and what possibility there is of rectifying them. While a certain amount of analytical investigation has been made by the Fuel Research Board, their main treatment has been of the instrument as a whole. The two reports are in general agreement, although we should hesitate to ascribe the accuracy given to the recorder by the Board, even on the basis of the figures in the Fuel Research Board's report. Mr. Blackie has experienced trouble with gas (in his case CO_2) liberated from the water on warming-up in the calorimeter, and leading to irregularities in the water-flow due to "air-locking," but points out that it may be peculiar to individual instruments. This difficulty has been encountered elsewhere; but the Birmingham instrument was exempt from trouble in this respect. Considerable stress is laid upon the variation in C.V. due to differences between room temperature and the mean temperature of the calorimeter body. In the winter time this difference may certainly become important unless special precautions are taken to control artificially both room temperature and inlet water temperature. This error is not detectable as a difference between the charted and observed C.V., where the non-recording portion of the apparatus itself is used for the determination of the latter.

The remarks of Mr. Charles Fairweather (Brentford) deal with a totally different instrument. It appears to be sound in principle, and pains have been taken to avoid many of the errors to which recording calorimeters are liable; but a test extending over several months would be a necessary preliminary to the forming of a final opinion.

Dr. J. G. Stewart raises the interesting point as to whether it is essential that a water-flow calorimeter should be used at all, or that the recorder should have the form of a standard calorimeter. The answer to this must certainly be in the negative, provided, or course, that the form of recorder contemplated is capable of verification with ease, or will retain its initial calibration accurately for an indefinite period. It is unwise, however, to overlook psychological points; and the use of a standard instrument of a conservative pattern, easily verified, certainly tends to inspire confidence in those who may have to deal with it.

Dr. Stewart urges the use of the still-water calorimeter as a standard for setting recorders, pointing out that much of the best work on gas calorimetry has been done with this type of instrument. In many cases, however, this has been because the amount of specially prepared and purified gases available for the test required was very limited. We submit that, in the case of a variable product like town's gas, the greatest difficulty would not be in determining the C.V., but in obtaining in small bulk a really representative sample of the gas. The difficulties in dealing with such constituents as CO_2, condensible and unsaturated hydrocarbons, greatly reduce the certainty of the process. Practical experience and the perusal of such a work as Coste's "Calorific Power of Gases," where such matters are fully discussed, do not give the impression that, for routine testing, the still-water calorimeter possesses the advantage over the flow-type which Dr. Stewart's remarks would seem to imply. The disadvantages are too serious.

Dr. Davidson pleads for a determination of C.V. at the average temperature and pressure of the consumers' meters. This would be a difficult proposal to make effective in practice; and, after all, the reduction to standard conditions does give us a fair and uniform basis of comparison for gas manufactured by different methods and in different parts of the country.

Gas Plant Explosion in California.

The Manager (Mr. J. H. Pughes) has given in the "Gas-Age Record" a graphic account of a gas-plant explosion which occurred at La Junta, California. From this it appears that in the early hours of a Saturday morning last September, the night superintendent of the plant tried to turn the stopcock valve on the high-pressure gas-main to Rocky Ford; and, finding it stuck, he took a hammer and struck the small end. The force of the blow broke-off the nut; and the 50 lbs. pressure on the main blew the stop out against an electric light, shattered the globe, and ignited the gas. The framework of the building being of wood, covered with corrugated iron, there was an immediate outbreak of fire, which, however, was quenched without much water falling on the coal-gas bench. The arrival of daylight showed the plant to be an awful wreck; but nevertheless gas was made again and turned into the mains the following Monday evening. Fortunately, with the exception of a few burns and bruises, no one was injured. The new building is to have a steel frame.

AT THE DAVIS GAS-STOVE COMPANY'S SHOWROOMS.

Visit by the London and Southern District Junior Gas Association.

The beautiful Oxford Street showrooms of the Davis Gas-Stove Company were closed to the general public last Friday afternoon—an arrangement thoughtfully made to increase the comfort of the members of the London and Southern District Junior Gas Association who had been invited to pay a visit of inspection. In the event, the 12,800 sq. ft. of floor space which these unique showrooms provide appeared to be none too great to accommodate the large number of members who assembled, under the President (Mr. Frederick A. Frost); nor was the time available any too long for all that there was to be seen and heard. From their arrival, when they were cordially welcomed by Mr. Cyril G. Davis (Managing-Director), and his staff, until the time of their departure some four hours later, there was not one dull moment.

Prior to commencing the tour of inspection, the visitors were divided-up into six parties, each taken charge of by one particular salesman, who was responsible for directing his own party to the half-dozen demonstration areas. In this way all confusion and congestion were avoided, and everything went with absolute smoothness.

Gas-Fires and Radiators.

There was, of course, a great deal to see and admire in connection with the modern fitted-in fires in the main showroom, the features of which were drawn attention to by Mr. Davis and Mr. H. H. Dashwood. The visitors were able to see here how attractive an up-to-date gas-fire is when displayed to the best advantage, and to realize that, however handsome may be its surroundings, a good gas-fire has no difficulty in "living-up" to them. No pains have been spared in making these showrooms everything that can be desired; and it would be hard indeed to suggest any way in which they could be improved. In this section, Mr. W. R. Twigg explained the improved "Radiation" patent silent burner, which is made in two types—simplex and duplex—the gas in the latter case being controlled by a single three-position tap, which permits of the end jets on either side of the fire being extinguished, if desired, leaving only the centre of the fire burning.

The "Efficiency" Hot-Plate.

In the cooking-stove section, there many useful appliances with which the members generally were already familiar; but one particularly interesting feature of this section, to which attention was drawn by Mr. Haycraft, was a new type of cooking-stove, fitted with a hot-plate known as the Davis "Efficiency." With this hot-plate, by the aid of an improved type of one, two, three, or four head "star" boiling-burner (consuming approximately 4 c.ft. of 500 B.Th.U. gas per head per hour), not only is the housewife able to carry out her boiling operations in a shorter time than was formerly the case, but a very great reduction in consumption becomes apparent when the quarterly gas bill comes in. It has been demonstrated that, whereas on a more ordinary type of gas-cooker the large boiling-ring took 10 min. 43 sec. to raise 3½ pints of water from 58° Fahr. to boiling-point, in an 8-in. vessel, with a gas consumption of 5·16 c.ft., the same work was done by a four-star burner on the "Efficiency" hot-plate in 10 min. 3 sec., with a consumption of 2·8 c.ft. of gas. In each case the pressure and adjustment of flame were regulated to the best advantage. It was pointed out that the better arrangement of the new "star" burners with which the "Efficiency" hot-plate is provided (whereby flame-contact is made just above the tip of the inner cone), absence of smothering, and the removal from over the burners of hot-plate bars (which conduct the heat away, rather than allow it to concentrate upon the desired object) are collectively responsible for the excellent result of this test.

Another useful appliance noted was the "Sentry" coke-boiler, which, in conjunction with a gas-cooker and an auxiliary gas-heated circulator for use in the summer time, will be welcomed by those undertakings that are anxious to promote coke sales. The "Sentry" will also consume all the combustible domestic refuse; and its design renders it particularly suitable for installation where space is limited.

The New "Hector" Geyser.

In the geyser department, members were received by Mr. H. F. Snow, who pointed out that geysers generally are constructed on two systems—namely, the "open" or direct heating, and the "sealed" type chamber heating. The "open" type is so constructed to meet the requirements of districts where the water is extremely hard, or with lime or iron deposits, owing to the fact that, when water reaches the degree of heat of 140°-160°, deposits begin to fall to the bottom of the chambers, and in time collect to such an extent that the water-heater is not heating the water, but the deposits at the bottom of the chambers, so causing leakages where the internal parts are soldered. It is recommended where possible to fix geysers of the "sealed" type.

An inexpensive heater of the sealed type is the new "Hector," which is cheap, not only in price, but for maintenance purposes. For getting at the burner, the whole of the body can be easily lifted off the base. The base itself is also different from the old pattern "Shamrock," insomuch that it has a removable burner, which is detachable from the base by unscrewing it from the cast-

iron gas-inlet arm. The condensation trough is in the base of the geyser; and the highest part of the trough is opposite the cold water supply, as this would be the coolest part of the geyser. The trough then has a downward grade to the outlet. The splay in the trough is made owing to the nature of the condensation, and so as to get it away from the geyser at the earliest possible moment. The boiler is detachable, and is removable from the top of the geyser by taking out the spout, and unscrewing the boss at the back, and with a special tool supplied unscrewing the nut which connects the boiler to the body of the geyser. It is not necessary to fix and re-fix the water and gas supplies. Consequently, when a boiler of this geyser requires repairing, or should the boiler be past repair, a new boiler can easily be fitted without inconvenience and loss of time in disconnecting the geyser and returning to the manufacturers. It is fitted with patent interlocking gear; but in this instance the firm have improved upon the gas-cock. By unscrewing the brass cap on the shoulder under the pilot-light, the whole of the cock comes out for cleaning purposes and pea-washing when necessary. All the parts are standardized; and the cost of maintenance is thus considerably reduced. A great deal is expected from this new type of heater.

"Nautilus" Gas-Fire Flues.

Major Wheeler was engaged in another part of the showrooms explaining to the visitors the principles and advantages of the "Nautilus" cast concrete ventilating gas-fire flues. It was pointed out by him that, during the last decade, great ingenuity and skill have been devoted to gas-fire construction; but the flue has only recently received the attention which is so necessary to obtain perfect results from a modern fire. The old clumsy and unnecessary large brick flue as designed for coal-fires is now being rapidly superseded in new buildings by the narrow cast concrete gas-flue built in the thickness of the walling. Extensive tests have proved conclusively that the best results can only be obtained by connecting a gas-fire to a properly designed flue. Some 15,000 of these patent "Nautilus" flues have been installed in buildings throughout Great Britain, and with the most satisfactory results. The advantages of this method of construction may be briefly summarized as: (1) A considerable saving in building costs; (2) increased floor space; (3) increased cubical contents; and (4) abolition of chimney-stacks. Many architects who have used the "Nautilus" flue blocks are of the opinion that this system will, in the near future, become the standard method of construction where gas-fires are the selected means of heating new buildings.

"Nautilus-Danish" Coke-Stoves.

A good deal of interest was taken in the fine display of "Nautilus-Danish" coke-stoves, of which Mr. Swaine was in charge. These are of sizes to meet all kinds of requirements, and of artistic designs to suit various positions. The principle of these stoves was recently explained and illustrated in the pages of the "JOURNAL." The fundamental principle of construction of the stoves consists in the provision of a deep fuel-bed. This prevents the ingoing air being immediately converted into carbonic acid, and passing directly to the chimney as flue gas, as a sufficient depth of incandescent fuel promotes a double reaction by producing carbonic acid gas, which, so soon as it reaches the hotter zone of the fuel column, is reduced to carbon monoxide, thus producing an exothermic reaction liberating the sensible heat of the fuel; the carbon monoxide becoming ignitable by the addition of another supply of oxygen (secondary air). The "Nautilus-Danish" coke-stove is, in reality, a small producer of the Mond or Dowson type. The stoves are made of non-air circulating and air circulating types. They are quite smokeless and of great heating efficiency; while exhaustive tests are said to have proved them to be remarkably economical as compared with an ordinary coal heating grate. They are lighted without difficulty, and once alight require practically no attention. By merely opening the fire-front and manipulating a simple valve, the cheerful effect of an open fire can be obtained.

An Address by Mr. Cyril G. Davis.

The tour of inspection completed, the visitors found tea awaiting them; and thereafter they had the pleasure of listening to a very practical little address by their host.

Mr. CYRIL G. DAVIS said he felt that he must commence his remarks by telling the members, as he had told them on other occasions, and just as sincerely, that they were most heartily welcomed. It was always a pleasure to see them, because they invariably manifested such keen interest and enthusiasm, and appreciation of what the firm found it possible to do for them. He had really nothing specially in his mind to speak to them about; but as they were there to see the Davis showrooms, he proposed to say a few words to them on the question of showrooms generally.

In going round the Davis premises that day, they had seen gas apparatus of various descriptions, and they had seen coke and coal stoves, and also decorative work. Some of them might have wondered why it was that the Davis Gas-Stove Company wanted to bother themselves with any business outside their own legitimate business of gas-stove manufacturers. He would tell them why. In the early part of 1914, they moved into the present building from Queen Victoria Street. The showrooms they then had were small; and it occurred to them that the day had come when they should take a bold step, and secure other showrooms in the West End of London which should be a credit to themselves and to the great industry to which they all belonged. At the same time, they felt they would like as far as possible to broaden their sphere. No doubt the members were aware that the gas-stove manufacturers, and probably the gas companies themselves, had not at that period the following among the architects to which they were entitled. On the other hand, a large proportion of the clients of the coal-grate people were the architects, in connection with grates, tiling, and mantel surrounds. So the Davis Company thought it would be an advantage to buy a coal-grate business; and they took over the Nautilus Fire Company. People came to them for coal-grates; and he could quote a great many instances in which the Company had been successful, as the result of such visits, in getting gas-fires into a house. See, in their present position, the amount of weight their arguments would carry. They could say: "We are manufacturers of both gas-fires and coal-stoves, so that you have come to the right house for good, well-balanced advice. They were able to recommend what was best from all points of view. This was an important factor in their purchase of the Nautilus business, which had been a great help to them in widening their sphere. With regard to the decorative side of the business, he had interested himself very much in what might be termed showroom reform; and he was anxious to do more than talk. He was anxious that gas undertakings should see the Company's ideas of what a showroom ought to be. Therefore they started a decorative department, and had already decorated and equipped a large number of gas showrooms throughout the country. To mention only a few of them, there were Derby, Coventry, Rochester, Redhill, and Blackburn. He understood from the engineers of these undertakings that they had derived enormous benefit from the new showrooms.

As in other businesses, advertising was a most important factor in the gas industry; and he knew of no better advertisement than a first-class showroom. Those of them who had visited any large number of gas undertakings over the country were no doubt aware of the great lack of enthusiasm, of enterprise, and of commonsense that was frequently displayed in connection with their showrooms. In these cases, the customers who came into the showrooms to pay accounts or make inquiries as to apparatus, saw a lot of gas-stoves displayed anyhow, jumbled-up together, undusted, and with the radiants broken; gas-burners covered with deposit, and having faulty shades and mantles; dirty ceilings and walls; broken showcards, sometimes badly written; and a showroom attendant who had not quite realized that he was alive. His advice was: "Have your showroom as good as you can make it." He did not urge them to spend a lot of money over it, because no doubt many undertakings would not be justified in doing so; but if they could not spend money, they could at least have the showroom kept clean, and the different appliances well displayed, so as to be a good advertisement of the cleanliness and tidiness of gas. Another important thing was to get a young, intelligent salesman, who was keen on his business, and who knew what he was talking about, because it must not be forgotten that the man in the showroom was the man who came in contact with the public, and who was going to give to the customer his impression of what the gas company was like. If they had the right man there, he would take care to see that his surroundings were on the best lines.

It was, of course, essential that the showroom attendant should know what he was talking about. He must take charge of the customer, and not let the customer take charge of him. There was much need of sound information, for it was extraordinary how little the public knew about gas-fires. One of the most important things they had to get home to the public was that the gas-fire was a perfectly hygienic piece of apparatus. If it proved unpleasant to sit in a room with one, this was because the fire had not been scientifically constructed. By the aid of diagrams, he explained the difference between the most modern types and those of years ago. The gas-stove manufacturer to-day made a fire that was capable of taking all its products of combustion through the flue outlet unaided by chimney draught or artificial means.

A Novel Fire Surround.

When a person came to the Company's showrooms for a gas-fire, they were not satisfied to supply him with a gas-fire only. They desired far more than this. What they wanted was to supply him with a gas-fire, and to see that it was going to be installed as a permanent and attractive feature. What they aimed at, and succeeded in doing, was to get a surround that would look as attractive as, if not more attractive than, tiles, at an expenditure of (say) 50s. They had already a fibrous plaster material which, however, was far too fragile to satisfy them as a permanent solution of the problem; and now they had something new, which was extraordinarily good. Showing some samples, he said the material was ¼ in. thick, and was absolutely fireproof. It was impossible to damage it in this way. One piece after having been stood for 2½ hours within 6 in. of the front of a fully-burning gas-fire, gave no sign of the ordeal to which it had been subjected. While in one way it was as hard as ivory, at the same time it could be easily cut with a saw. All that would be necessary would be to mark the size of the opening, cut the material, and then fix it in place. Then there would be a gas-fire fixed permanently which would be a credit to the gas consumer, a credit to the gas company, and a credit to the manufacturer. They did earnestly desire their gas-fires to be fixed permanently; and it was for this reason that they had been so anxious to find a

suitable surround. The new material to which he had referred would in the first place be available in four designs and in different colours.

Unsuitable Apparatus.

Resuming the subject of his address, he said there were many other things with which a showroom attendant had to be well acquainted. One of these was the great danger of letting people have gas-stoves that were not suitable for the particular room in which they were to be fitted. If flueless stoves such as were seen advertised now were placed in a room without any ventilation, one must get products of combustion. Such stoves were no doubt excellent if properly used; but they must be careful not to misuse them. One piece of apparatus wrongly applied would get the whole industry condemned. As to gas lighting, unfortunately a large number of people connected with gas seemed to think that it was done. This, however, was very far from the truth. Speaking for himself, he had a cottage in the country fitted with gas, and a flat in London with electricity; and he preferred gas lighting every time. It was much more comfortable to read by, and better in every way. With suitable burners—and, of course, the proper gas—there could be no doubt that gas would continue to have a very big following. The pneumatic switch, which was very good, was a great aid to them in this matter. So far from being dead, gas lighting was very much alive.

The PRESIDENT said they might regard their visit that afternoon as a fitting sequel to that which was made during the summer to the Company's factory at Luton. Opportunities such as the firm had offered them, could not fail to impress them all with the immense advantages possessed by gas lighting, cooking, and heating, from hygienic, labour saving, and other points of view. The Association were very much indeed indebted to the Davis Gas-Stove Company for having afforded them these facilities, at the cost of a good deal of dislocation of the firm's business. The visit had been made even more attractive by the inspiriting remarks they had just heard from Mr. Cyril Davis. Gas lighting only required cultivating in a proper manner to fully restore to it its old prestige.

Mr. S. B. CHANDLER proposed a hearty vote of thanks to Mr. Cyril Davis and the Company for their invitation and for the hospitality they had extended to the members, as well as to all the members of the staff who had been assiduous in explaining everything to them. Showrooms, he declared, were the gateway to all businesses; and the place where the goods were displayed should always be a criterion of what one could do for a customer. Therefore Mr. Davis's remarks were of the greatest importance.

Mr. F. AINSWORTH, in seconding, remarked that the address was very encouraging; and they as gas people had much to be encouraged by. Great credit was due to the firm for providing such a showroom as they had seen that day.

Mr. W. J. LIBERTY supported the vote, which was enthusiastically passed.

Mr. DAVIS, acknowledging the vote, said it had been a great pleasure to have the Association there, and a hearty welcome would be extended to them whenever they desired to come again.

Scientific Control in the Gas Industry.

Almost entirely avoiding technical details, Mr. H. Rands, M.A., B.Sc., the Chemist to the Wellington Gas Company, Ltd., was able to show conclusively, in a paper read at the annual meeting of the Gas Companies' Association of New Zealand (Incorporated), the necessity for scientific control in the gas industry. He laid emphasis, first of all, upon the point that the manufacture of coal gas and its bye-products is fundamentally a purely chemical process, and hence the need throughout for the closest chemical control. To prove his case he took two illustrations—coal purchases and coal carbonization—in both of which cases, he said, control tests would be an aid to economy and safety. He urged that the businesslike way of regulating contracts for coal is by analysis; and that those who have visited some of the New Zealand mines know that, if pressure were brought to bear, great improvement could be achieved, at little cost, in the methods of winning and transporting coal, with a view to keeping-out adulterants. There are, he went on, wide variations in ash content; and there is no doubt that the gas undertakings of New Zealand collectively, and some of them individually, could economize to the extent of many thousands of pounds a year by close attention to this one phase of their operations. With regard to the carbonizing plant, chemical analysis of the waste gases in the flues detects at once any lowering of efficiency, and also points to the remedy. In connection with this point, he gave the following quotation from the "Intercolonial Gas Journal of Canada:" "In a works using 28,000 tons of coal per annum, if 3 p.ct. of carbon monoxide were permitted to pass through to the chimney, a loss of 2000 tons of coke would occur; or if 8 p.ct. of oxygen were permitted in the waste gases, there would be an additional fuel consumption of 9000 tons of coke." Close and constant control is also necessary with modern methods of very high temperatures, which are much nearer the danger limit as regards injuring the retort-settings. While the larger gas undertakings can secure this scientific control independently, the author suggested that the smaller ones should co-operate in providing a central laboratory.

TOWN'S GAS AND THE GAS-ENGINE.

By EDWARD CROWTHER, M.Eng.

[A Paper read before the Liverpool Engineering Society (Student Section), Dec. 8.]

In preparing a paper for the consideration of this Society, the author has endeavoured to choose a subject of general interest, rather than one of a more restricted nature with which a minority only might be in touch. Such a choice has, of course, the disadvantage of lending a certain vagueness to the matter—only avoidable by concentrating on one or two salient points. With this consideration in view, therefore, the author intends to regard his subject from two aspects only:

(1) The gas-engine, regarded as a gas appliance, much as one regards a gas-cooker, incandescent burner, &c.—that is, as a piece of apparatus by the use of which one is enabled to obtain a definite service from town's gas, in this case the production of motive power.
(2) Town's gas regarded as a fuel for use in an internal combustion motor, comparable with oil, petrol, &c.

In dealing with the former aspect of the subject, one is tempted to embark upon a lengthy historical description of the gas-engine from the time of its first appearance as a commercial proposition, of the law-suits involving its patent rights, of its speedy advance into a position of great importance as a prime mover (when it was confidently predicted that it would shortly supersede steam), of the serious check sustained on the introduction of the steam-turbine, and of the prospects of the production of a gas-turbine able to beat the steam-turbine on its own ground. Such a description, however, would hardly be in place in this paper, and only a few points of historical interest need be touched upon, in as far as they have affected design.

Perhaps the two most important modifications in connection with the Beau de Rochas cycle gas-engine, which have done more to facilitate its development than any others, have been the introduction of means of varying the timing of the ignition of the compressed charge, and the adaptation of the electric spark to ignition. As a result of these, it became possible to increase compression pressures, to use a wider range of fuels, and very greatly to improve the thermal efficiency of the engine; while their effect upon its design—particularly in regard to the size and power of units, and the production of multi-cylinder engines—have been profound. Further, the effect of these improvements, and of other developments consequent upon them, has to some extent been to displace town's gas from its early unchallenged position as the sole fuel for the internal combustion engine, and to substitute (in the larger units at least) low-grade power gases of various types, while the later parallel development of the liquid fuel engine has again divided the field.

The result has been that the design of the gas-engine has been modified along various lines suggested in part by practice other than that with town's gas; and the tendency in the design of medium-sized units has been to produce one capable of working on more than one type of fuel. Speaking generally, the progress of design has been all to the good; and if the town's-gas engine has suffered in any way, it is in respect of the fact that the maker has become detached from, and independent of, the producer of the fuel for which the engine is designed. In the case of practically every other fuel used in internal combustion work, the engine manufacturer is fully aware of its nature and properties, which are, moreover, nearly constant; whereas in the gas industry a gradual but definite change in practice was in progress even before the war—a change greatly accelerated by the war, and still in progress.

ALOOFNESS OF GAS-ENGINE MAKERS.

Unlike the manufacturer of gas fires, cookers, and other apparatus served solely by town's gas (who is compelled to keep in close touch with the practice of the gas industry, and to modify his designs accordingly), the engine maker has stood somewhat aloof, maintaining an attitude not in the best interests of either industry. As a striking instance of this lack of co-operation between the two may be cited the guarantees of performance given by the engine maker, who even to-day in many instances bases his figures on a gas of about 600 B.Th.U. gross per cubic foot; whereas the average quality of town's gas throughout the country is at present probably less than 500 B.Th.U. The effect of this discrepancy is that the figures given as probable consumption of the engine are too low by perhaps 20 p.ct.; and its overload capacity may also be slightly reduced, with the result that the purchaser becomes dissatisfied.

On the part of the manufacturer, however, it should be pointed out that the quality of town's gas varies widely in different areas; so that no definite guarantee can be given without a knowledge of the destination of the engine. Competition between different makers is also a factor of importance in this connection; for if one manufacturer bases his figures for consumption on a gas of high calorific value when preparing his catalogues, others are obliged to follow suit, or run the risk of losing business, since the average purchaser of small engines at least has often neither the inclination nor the ability to criticize the figures submitted to him—until after he has bought the engine. Now that the system of selling gas on its heating value is coming into force, however, it is

to be expected that these criticisms will cease to hold good, and that the engine makers will base their guarantees on the figure "H.P. hours per therm."

One other instance of this lack of connection between the two industries may be given in the practice of one well-known firm of turning out—at least, up to very recent years—a class of engine designed for town's gas with no regulator on its air-supply pipe. Down to a certain quality of gas, all is well, and the mixture can be adjusted by opening-up the gas supply. Below this quality, however, the mixture becomes too weak even with the gas-cock full open, and much annoyance may be caused to a non-technical user by the difficulty experienced in starting-up the engine, and its inability to carry full load.

With the reduction in quality of gas which has taken place of late years, many engines must have suffered to a slight extent in volumetric efficiency, and consequent power output, as a result of the throttling-down of the air supply to enable a larger proportion of gas to be drawn into the cylinder. Unless the pipe connections to the engines are of ample size, this throttling-down results in only partial filling of the cylinder on the suction stroke, with consequently lowered compression and effective pressures.

As the situation may be summed-up by a possibly prejudiced observer, the engine manufacturing trade follow rather a short-sighted policy of co-operating only with the gas industry in selling their engines (in the sale of which both are equally interested). Having sold them, and not being interested in the sale of gas, they largely throw on to the gas industry the burden of seeing that the engines continue to run and to give satisfaction. Often enough, this system appears to work quite well; but in other cases business must be lost to both industries, where the visit of the makers' representative might have put matters right—particularly in the smaller towns, where the gas concern cannot be expected to possess a staff of engine experts.

In the foregoing, the point of view of the engine owner has been but lightly touched upon. Since the ultimate success or failure of the gas-engine industry rests in his hands, the subject will repay attention.

Attention to Running and Maintenance.

Though no great skill is required to keep an engine in reasonable running order, it is astonishing in many cases how little attention is given, to the smaller sizes in particular, and how little intelligence is brought to bear on the question of their proper running and maintenance. In small workshops, in timber stores, in builders' merchants' yards, and the like, where a small engine has been installed, no one need be surprised to find that the old man or the boy who cleans-up is also engineer-in-charge. His ideas on the operation of the engine are frequently original and refreshing, though perhaps less remarkable for their accuracy. The housing of the engine is often of a piece with the rest. If it is accessible, the lighting is bad, or, if the lighting is satisfactory, the weather protection is inadequate. Under such conditions—which are not so unusual as might be supposed—it is not remarkable that the running is not invariably satisfactory. Yet on the first signs of trouble other than mechanical breakdown, the owner, having doubtless found by experience that the man who sold him the engine is a very inaccessible individual, at once complains to the local gas concern.

Why the Gas is Blamed.

Generally speaking, the unskilled gas-engine attendant has two theories very firmly implanted. If his engine refuses to start, or runs badly, the gas is bad; while if it refuses to develop full power or an overload, the pressure is bad, and only by putting the engine right—which may involve nearly any sort of adjustment or repair—can be persuaded that he may be mistaken. As the power of the unit increases, so, generally speaking, does its treatment improve. Yet even so, the "bad gas" theory dies hard.

As an instance, perhaps the author may be permitted to cite the following: A manufacturing firm of some importance purchased a second-hand engine of a well-known make, rated 100 B.H.P., and originally used on suction gas. This they arranged to run on town's gas, driving a dynamo at about half full load. Later, however, more load was required; and it was found that the engine pulled up at about 65 B.H.P. A letter to the makers brought a reply stating that when the engine left their hands it was in perfect running order, and suggesting that the gas was at fault. Acting on the suggestion, a complaint was made to the gas concern, whose inspector reported that there was ample pressure, that the meters were quite large enough to pass the quantity required, and that the consumption per H.P.H. was reasonable. The author then went personally to see where the trouble lay, and on indicating the engine found that the pressure at the end of the suction stroke was 6 lbs. per sq. in. below atmosphere.

The cause of this was eventually found to be in the gas stop-valve on the engine. This, the usual type of plug valve, has two ports cut in it—a large one marked suction gas, and a small one for starting light on an auxiliary town's gas supply. Evidently when the engine was re-erected after being bought second-hand, the valve had been fixed in such a position that the supply was taken through this small port; and on taking the valve out and turning it round, it was found possible to obtain 110 B.H.P. from the engine. This very slight adjustment could quite well have been made by the owners, had they not been obsessed by the "bad gas" theory. As it was, the engine was in imminent danger of being superseded by electricity at the time of the author's visit.

The object of the foregoing is to emphasize the fact that in far too many cases the owner possesses only the most elementary knowledge of the operation of a gas-engine, and expects it to continue to run for an indefinite period with only the most superficial attention, and often under adverse conditions; and not only to run, but to maintain its efficiency. It would appear, therefore, that if gas-engine power is to be maintained in the face of competitions from other forms of power, the gas undertakings must relieve the owners—whose ideas are not easily changed—of a part of the trouble of upkeep, by a periodical inspection and adjustment of their engines, followed by reports as to their condition, containing any recommendations as to renewal of parts, &c. Such a system was, in fact, initiated by the two leading London gas companies previous to the war, and must have done much to maintain and extend their sale of gas for this purpose. At the same time, it seems only reasonable that the manufacturing trade should co-operate in this work, since it is in their interest just as much as in that of the gas industry.

One may note here that the position is somewhat different in regard to other gas appliances, the ownership of which is often vested in the gas concerns, who charge a rental for their use, and through whom, moreover, pass the bulk of sales of new appliances, and of spare parts, to such consumers as desire to own their appliances, with a consequent small profit on the sales.

Town's-Gas Engine as a Prime Mover.

Before passing on to the next portion of the paper, it will be proper to investigate briefly the scope of the town's-gas engine as a prime mover. In such an investigation, a comparison with electrical power is almost inevitable; and here one is on debatable ground, the scene of many a hard-fought, if inconclusive, battle.

As regards the range of power over which engines driven by town's gas are applicable, one may take the figures 1 to 200 B.H.P. Above this range, it will generally be found that producer gas will be a more economical fuel than town's gas, and one able to hold the field up to the lower economical limit of the steam turbine's range. Up to this power, however, electrical power—*i.e.*, as generated at central stations, presumably by steam—is an active and successful competitor. While in many cases special circumstances, such as available space, noise restrictions, &c., favour electrical power, yet much of its success over the field in which town's gas is applicable is based on fallacious arguments, the most common of which is perhaps that dealing with upkeep and repairs charges. An electric motor is no more fool-proof than a gas-engine; and though, on the one hand, its efficiency suffers very little as a result of neglect, yet if it happens that a short or similar trouble occurs, the damage may be very much more extensive and costly than any ordinary gas-engine trouble. In point of overloads, too, while it is admitted that an electric motor will carry a temporary overload which would pull a gas-engine up, yet if a practice is made of largely overloading a motor, trouble will eventually ensue—probably all the more serious for being delayed.

The question of costs and financial statistics generally demands a paper of its own, and has of recent years received many such. The following figures, extracted from Sir Dugald Clerk's paper to the Royal Society of Arts, in March, 1919, together with a few conclusions drawn from them, are all the author intends to include in this paper.

Average thermal efficiency of gas manufactured in the United Kingdom . . . . . [Note. This figure is obtained by expressing the heat in the gas produced as a percentage of the sum of itself and the heat lost in its production. The heat in the coke and tar produced is still available.]	46 p.ct.
Over-all efficiency of gas-engine	25 ,,
∴ ,, ,, of power production by town's gas	11½ ,,
Reckoning the price of gas for power at 4d. per therm, 1 B.H.P. hour costs	0·4d.
Efficiency of electricity production by steam-turbine (coal to electricity) . . . . . [Average figure for the year ended March 31, 1918.]	8·5 p.ct.
Efficiency of electric motor	90 ,,
Over-all efficiency of power production by electric motor . . . . . (Taking no account of transmission losses.)	7⅞ ,,
Reckoning the price of electricity for power at 1d. per unit, 1 B.H.P. hour costs	0·83d.

While the foregoing figures by no means account for the whole of the costs of either form of power, it is evident that gas power has, in respect of what may be called fuel costs, a considerable advantage over its competitor; and one must look elsewhere for the reasons for the growth of the latter. Convenience is certainly a great, if exaggerated, factor; but another factor of importance is certainly the mistaken idea of many power users that to be up-to-date it is necessary to instal an electric drive, irrespective of other considerations. In passing, it may be mentioned that many works have of recent years been fitted in this manner, to the displacement of other forms of power, as a means of absorbing money which would otherwise have gone as excess profits duty.

Neglect of Gas Power.

Passing on to the second part of the paper, it may be said that gas power is at present undeservedly neglected, as a result of the popular imagination, fostered by the statements of interested individuals, having taken hold of electricity as the only form of power worthy of consideration.

Dealing now with town's gas as a fuel for the internal combustion engine, it will be necessary, first, to investigate its composition. It has been already stated that ideas have changed, and are still changing, in the gas industry, and that the quality and composition of town's gas differ widely in different areas of supply; but, even so, the types of gas manufactured may be divided roughly into two classes, quite irrespective of the methods of production.

These types are, first, that known as straight coal gas, being the gas produced by the distillation of coal, whereby the volatile constituents are liberated; and, second, that known as water gas—a mixture in approximately equal proportions of hydrogen and carbon monoxide produced by the action of steam on red-hot carbon. Generally speaking, the gas supplied to consumers consists of the former of these two types, or of a mixture of the two, in either case usually diluted to a greater or less extent by inert gases such as CO_2 and N_2, or by air, introduced deliberately or otherwise in the process of manufacture, and sometimes enriched, in the case of water gas, by the addition of gases obtained by cracking heavy mineral oils.

This paper is not concerned with the methods by which these various mixtures are produced—suffice it to state that at the present moment the average calorific value of the gas supplied in this country probably lies between 450 and 500 B.Th.U. gross per cubic foot; while the extreme values are widely divergent from the average.

The following figures, extracted from the first report of the Gas Investigation Committee, 1918, while not put forward in the report as typical, will serve to illustrate the composition of the two chief types of gas referred to, and the characteristics of a variety of mixtures of gases of varying composition and quality.

(1) *Straight Coal Gas with Low Inerts.*

[NOTE.—A certain small proportion of inerts is inherent in coal gas, and cannot well be avoided.]

Composition.	P.Ct.	Inerts.	P.Ct.	C.V.
CO_2	2·7	CO_2	2·7	615 gross
O_2	0·3	O_2	0·3	552 net
C_nH_m	3·4	N_2	7·1	
CO	7·1			Ratio $\frac{\text{Gross}}{\text{Net}}$ = 1·115
H_2	46·0	Total	10·1	
CH_4	33·4			
N_2	7·1	CO_2	2·7	Sp. gr., 0·430
		N_2	6·0	
		Total	8·7	

Volume of air required for combustion of 1 c.ft. of gas	5·2 c.ft.
Volume of self-combustible mixture per c.ft. of gas	6·2 ,,
C.V. of self-combustible mixture	99 B.Th.U. gross 88 B.Th.U. net.

(2) *Blue Water Gas with Moderate Inerts.*

Composition.	P.Ct.	Inerts.	P.Ct.	C.V.
CO_2	8·2	CO_2	8·2	314 gross
O_2	0·9	O_2	0·9	285 net
C_nH_m	0·7	N_2	9 9	
CO	30·5			Ratio $\frac{\text{Gross}}{\text{Net}}$ = 1·103
H_2	46·3	Total	19·0	
CH_4	3·5			
N_2	9·9	CO_2	8·2	Sp. gr., 0 635
		N_2	6 5	
		Total	14·7	

Volume of air required per c.ft.	2·3 c.ft.
Volume of self-combustible mixture	3·3 ,,
C.V. of ,, ,, ,,	95 B.Th.U. gross 86 B.Th.U. net

The foregoing figures may be regarded as representing the extremes of the scale of calorific values of town's gas; while the next table, derived from the same report, shows certain of the characteristics of various mixtures of coal gas with inerts, air, and water gas, and also of carburetted water gas.

Examining this table, which embraces a wide range in respect both of composition and calorific value, one at once observes the very marked resemblance between the figures for calorific value per cubic foot of self-combustible mixture. Were this the only factor to be considered, it would be possible to obtain almost identical maximum power output from an engine, irrespective of the nature of the gas supplied, since equal quantities of what may be called potential heat could be introduced into the cylinder in all circumstances; while the power is determined entirely by the quantity of heat developed in the cylinder. This factor, though of considerable importance, is not, however, the sole determinant of the practical limit to the maximum power output of an engine. It is generally accepted that, in order to avoid pre-ignition, bumping, and irregular firing, the proportion of hydrogen drawn into an engine cylinder should not exceed about 5 p.ct. of the whole volume of gases present at the end of the suction stroke, including the products of combustion left in the clearance space.

Gas.	C.V.	Inerts. P.Ct.	Air. C.Ft.	C.V. Net of Mixture.	P.Ct. H_2 in Mixture.	Added Column. C.V. net of Mixture Restricting H_2 to 5 p.ct.
Coal gas "A"	615					
	552	10·1	5·24	88·2	7·36	60·0
Coal gas "B"	525					
	472	18·7	4·41	87·2	7·49	58·3
Coal gas "C"	488					
	441	26·4	4 06	87·1	7·42	58·8
Semi-carburetted water gas	446					
	409	24·6	3·73	86·4	7·61	56·8
Coal gas *plus* air.	373					
	335	43·8	2·88	86·3	7·41	58·4
Coal gas with high inerts*	368					
	330	38·8	3·02	82·2	8·5	48·4
Coal gas with blue water gas 1 : 2.	365					
	330	20·2	2·87	85·3	8·89	38·2
Blue water gas	314					
	285	19·0	2·31	86·1	14·0	30·8

* Obtained by dilution with Mond gas.

With this consideration in view, a further column can be added to the table showing the greatest allowable calorific value of the mixture of products, air, and gas exploded in an engine cylinder for each type of gas, as above.

It should be mentioned at this stage that the sixth type of gas in the list—"Coal gas with high inerts"—cannot be regarded as typical of present-day practice, as it consists of a mixture of coal gas and Mond gas; the latter containing a high percentage of hydrogen.

A coal gas and inerts mixture, as normally produced by drawing furnace gases into the retorts as a result of over-exhausting while working, would show a higher mixture value referred to a 5 p.ct. H_2 basis than the particular mixture included in the table. Referring again to this last column of figures, it would seem that the maximum power available from a town's-gas engine depends on the ratio between the amounts of coal gas and water gas present in the fuel supplied to it, except where the latter gas is carburetted with oil, in which case as high a duty will be obtained as with coal gas.

While this is to some extent the case, the maximum and minimum powers available are not so widely divergent as would appear—*i.e.*, as 2 : 1—for the reason that it is not practicable to employ regularly and continuously a mixture the calorific value of which greatly exceeds 40 B.Th.U. net per cubic foot. The truth of this statement becomes evident upon reference to a paper read by Mr. W. A. Tookey before the Institution of Mechanical Engineers in January, 1914, on the subject of gas-engine testing. In this paper was first brought forward the importance of what has since been known as the "Tookey Factor"—namely, the ratio between the mean effective pressure developed in the cylinder of an internal combustion engine and the calorific strength of the fuel-air mixture supplied.

Mr. Tookey established experimentally that the highest value of this factor attainable under normal conditions was in the region of 2·2; and this figure was confirmed on theoretical grounds by Captain Sankey, who deduced a formula expressing the factor in terms of thermal efficiency, charge temperature, and compression ratio.

Assuming, then, the value of this factor to be 2·2 under efficient conditions, the useful limit to the mixture strength depends solely on the maximum practicable mean effective pressure developed. In ordinary practice, it is not safe to rely on a maximum mean effective pressure greater than 95 lbs. per square inch; while for continuous work, the engine should not be called upon to develop more than 85 lbs. per square inch.

On this point, the following may be quoted from Mr. Tookey's paper:

> Very efficient cooling and careful adjustment of ignition timing devices are required when engines are called upon to deal with loads necessitating a continuity of explosions producing mean pressures of the order of 90 lbs. per square inch. . . . The only limit to an engine's capacity for overload . . . is the liability of pre-ignition of the charge during the final portion of the compression stroke.

This, then, justifies the statement that 40 B.Th.U. per c.ft. of mixture is the useful upper limit; and, pursuing the argument a little further, the capabilities of the various types of gas in question to develop loads calling for mean effective pressures of (1) 85 lbs. per sq. in., and (2) 95 lbs. per sq. in. can be inspected, on the assumption of a Tookey factor of 2·2. As a result, it will be found that, except in the case of blue water gas and a mixture of this and coal gas in the proportions given, these powers can be developed whatever the type of gas. With blue water gas only 80 p.ct. of the lower, or 71 p.ct. of the higher, load can be attained; while in the mixture, the figures are 99 and 88 p.ct. It is therefore evident that, provided the proportion of water gas is not excessive (say, under 50 p.ct. of the whole), it is a matter of little importance to the power user what the composition or the calorific value of the gas may be, provided that they remain reasonably steady. [N.B.—A good quality producer gas will give results about on a par with coal water-gas mixture quoted.]

While the composition of the gas has but little effect upon the power output of the engine, it makes its influence felt in other directions of secondary importance, on one of which a few words may be said. This point—that of the time occupied in attaining maximum pressure from the instant of ignition—is considerably affected by the nature of the gas mixture, irrespective of the calorific value of the fuel itself. An attempt to put forward a definite theory as to how composition affects flame speed (and so the time occupied in attaining maximum pressure) presents many difficulties, since many purely mechanical considerations also come into play, making it a troublesome matter to eliminate them and to reconcile any such theory with experimental data.

Of these purely mechanical factors, which are independent of the composition of the gas, may be mentioned compression pressure, mean effective pressure, mean hydraulic depth, &c., &c.; while the degree of turbulence in the cylinder (of which piston speed is a factor) has a very marked effect. [Note Sir Dugald Clerk's experiments on this subject—Fifth Report of the Gaseous Explosions Committee of the British Association.]

It is stated in "Molesworth's Pocket Book," in fact, that "the rapid propagation of the flame is chiefly a mechanical process." In these circumstances, and not having been able to find any record of experimental work on composition in relation to ignition speed under practical conditions, it is with some hesitation that the author would suggest a partial theoretical analysis of the question on the following lines.

In considering this and other thermodynamical points in connection with the internal combustion engine, it should be remembered that the working substance consists chiefly of nitrogen, the percentage of which is rarely less than 70 p.ct. by volume during any part of the cycle. The engine cylinder may be regarded as containing during the compression stroke a large proportion of this gas, "carburetted" with a correctly adjusted mixture of oxygen and inflammable gases and diluted with small quantities of CO_2 and excess oxygen.

For the purpose of this investigation, let it be assumed that the carburetting mixture consists, in turn, solely of hydrogen, carbon monoxide, methane, and ethylene, each with its appropriate volume of oxygen. Assume, further, that in each case no diluents other than nitrogen are present, and that the net calorific value per cubic foot of cylinder content is 40 B.Th.U. The number of volumes of cylinder content which will under these conditions contain one volume of the carburetting mixture can then readily be calculated for each case.

By Avogadro's law, this figure is proportional to the mean number of nitrogen molecules present per molecular explosive group, and the mean distance apart of explosive groups is proportional to the cube root of this figure. If, now, it be assumed that one explosive group is caused to ignite, the heat received by neighbouring groups from its radiation will be inversely proportional to the square of their distance from it. It may therefore be assumed that the speed of flame propagation will vary as the original figure (cylinder volumes per unit explosive volume) to the power *minus* two-thirds.

The following figures will perhaps explain the foregoing more clearly:

(1) *Lower C.V. of Self-Combustible Mixture with Oxygen of—*

H_2	(Requires ½ its vol. of O_2)	. .	CV = ⅔ × 290 =	195	B.Th.U. C.Ft. Net.
CO	,, ½	,,	CV = ⅔ × 340 =	226	,,
CH_4	,, 2	,,	CV = ⅛ × 950 =	320	,,
C_2H_4	,, 3	,,	CV = ¼ × 1500 =	375	,,

(2) *Proportion of Self-Combustible Mixtures Added to Nitrogen to Realize 40 B.Th.U. Net per Cubic Foot of Whole Mixture.*

H_2	to Oxygen mixture	1 to 4·9
CO	,, Oxygen ,, ...	1 ,, 5·6
CH_4	,, Oxygen ,, ...	1 ,, 8·0
C_2H_4	,, Oxygen ,, ...	1 ,, 9·4

(3) *Concentration Factor in above Mixtures as Affecting Flame Speed.*

H_2	speed varies as	(4·9) − 3	= Factor	= 0·35
CO	,, ,,	(5·6) − 3	= ,,	= 0·315
CH_4	,, ,,	(8·0) − 3	= ,,	= 0·25
C_2H_4	,, ,,	(9·4) − 3	= ,,	= 0·225

A further factor inherent in the gas, and also affecting flame speed, is the amount of heat liberated by each combustible group as it explodes. This heat is, in the instant of its liberation, used to raise the temperature of the direct products of combustion—that is, before the heat can be shared by the nitrogen present, or otherwise dissipated—and can be expressed as B.Th.U. per pound of direct products; whence, taking into account the variation of their specific heats at high temperatures, their instantaneous theoretical temperatures can be calculated. It is generally accepted that the intensity of heat radiation varies as the fourth power of the temperature of the radiating body, so that here, again, may be derived a factor influencing flame speed.

The calculations are as follows:

(1) *Heat Liberated per Pound of Direct Products, B.Th.U. Net.*

H_2	5800 B.Th.U.	CO	2800 B.Th.U.
CH_4	4240 ,,	C_2H_4	4330 ,,

(2) *Theoretical Temperatures Attained (Mallard and Le Chatelier's Figures for Specific Heats).*

		Ratio.	Ratio to the Fourth Power.
H_2	3300° C.	1·27	2·60
CO	2600° C.	1·00	1·00
CH_4	2950° C.	1·14	1·65
C_2H_4	2900° C.	1·11	1·54

While the author does not suggest that these two are the only factors inherent in the gases themselves which affect the rate of ignition, they would appear to be of predominant importance. Multiplying them together, a third ratio is obtained, which may be called the theoretical ignition speed factor of the gas as follows:

H_2	Speed factor = 2·90
CO	,, ,, = 1·00
CH_4	,, ,, = 1·32
C_2H_4	,, ,, = 1·10

These figures square with experimental facts in that they explain the known rapidity of inflammation of hydrogen, which, as has been mentioned, necessitates its proportion being kept down to 5 p.ct. of cylinder content. They further agree with the fact that a producer gas containing a high proportion of CO ignites more slowly than (say) town's gas.

In a complete analysis of this question, the influence of diluents other than N_2 would have to be taken into account—it may be mentioned in passing that CO_2 absorbs a large proportion of radiant energy passing through it, whereas O_2 and N_2 are almost completely deathermanous—while the temperature of ignition of the various combustibles must also play a part. The limits of this paper will not, however, permit of any further expansion of this subject, nor of a discussion of the effects of composition on the variable specific heat theory as affecting thermal efficiencies.

In conclusion, a few words on the future position of town's gas as an engine fuel will not be out of place. Following the passing of the Gas Regulation Act, by which local gas concerns are given very complete liberty to prescribe their own calorific standards, and by which practically all restrictions as to composition have been removed, the gas industry is in a process of "settling down." Ideas as to what constitutes the best practice are very divergent; and it would be foolish to prophesy what will be the final outcome. At the same time, all ideas are tending towards the same ideal—that of cheapened production per calorific unit; and it is to be expected that this ideal will be steadily approached as time goes on. In these circumstances, and bearing in mind the very slight effects of composition variations on engine operation, it may confidently be stated that the future of the town's-gas engine has never been more promising than it is to-day.

Gas-Tubing Specifications.

According to the 1921 standard performance specifications for flexible gas tubing of the American Gas Association Committee on Standardization of Gas Appliance Specifications, such tubing used for connecting gas appliances must be in lengths of 6 ft.; "leakage" being defined as not exceeding 0·02 c.ft. per hour per 6 ft. length. Each length of tubing shall be labelled with a tag attached to the tubing or a marking on the end-pieces, or both. The inscription shall state the manufacturer's name, the length of the tubing, and the capacity or rate of gas flow in cubic feet per hour under the condition of a pressure drop of 1 in. of water. Bare metal tubing depending for its tightness upon a thread-like rubber or similar packing is not permissible. A number of tests are detailed; and the following six requirements are defined: Strength, flexibility, resistance to freezing, resistance to heat, elasticity of rubber slip-ends, and gripping power of rubber ends. As to strength, the length of tubing shall be so resistant to crushing that it will support a transverse load of 75 lbs. per lineal inch without either a leakage of gas or a restriction of the flow; it shall be able to withstand without leakage, for five minutes, a steady lengthwise pull of 50 lbs.; it shall be able to withstand without leakage or becoming detached the shock resulting when a 5-lb. weight, if fastened at one end to the length of tubing, falls 30 in., while the other end is supported by the rubber slip end attached to a standard hose nozzle held in a vertical position; and when extended its full length it shall be capable of withstanding without leakage a twisting movement acting clockwise and counter-clockwise, sufficient to produce an angular deflection of 180° per foot of length. The tubing must also return to its original position at the conclusion of the test. In the matter of flexibility, the tubing must be able to make continuous contact with a cylindrical form 3 in. in diameter for 180° of its circumference, when a weight is suspended from each end of the tubing. The weight at each end for tubing not greater than ¼ in. internal diameter shall be 2 lbs., and for tubing from $\frac{5}{16}$ in. to ⅝ in. inclusive 4 lbs.

Estate of the value of £655,000, of which £652,636 is net personalty, has been left by Mr. John Hutton Balfour Browne, K.C., who died on Sept. 27, in his 77th year.

There is to be a meeting in the Municipal Technical College, Halifax, next Saturday afternoon, of the Yorkshire Junior Gas Association, when Mr. Francis J. Bostock will deliver a lecture (illustrated by lantern slides) on "Recent Developments in the Application of Gaseous Firing for Industrial Purposes."

MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.

Visit to the Works of the Richmond Gas Stove and Meter Company, Ltd.

On Wednesday last, the Manchester and District Junior Gas Association, accompanied by the President (Mr. J. B. Stewart) and the Secretary (Mr. J. Alsop), visited the works of the Richmond Gas Stove and Meter Company, Ltd., Warrington. The party, numbering about 70, were conveyed to the Grappenhall Works in charabancs, and were welcomed at the works by Mr. H. M. Thornton and Mr. J. W. Slack (Managing Directors), Mr. F. W. Richmond, and Mr. Arthur Slack (Directors).

Mr. J. W. SLACK said he hoped the visit would prove a profitable one, and that they would have pleasing memories of it.

Mr. THORNTON said he did not think many of the members present would remember the last visit of the Association, which took place in 1908. But he had pleasant recollections of the interest which was shown on that occasion. They were again glad to welcome the Association, as it was felt that manufacturers of gas appliances should be in close touch with the men engaged on the gas-making side of the industry. It was only by an interchange of views and ideas that they were able to produce a perfect article for use by the gas consumer. Visits like the present one would give some idea of the progress made during the last few years. Take the Richmond standard gas-fire for instance. This was totally different in every way compared with 1908. It was thoroughly hygienic and healthy; the products of combustion being carried completely away by the flue outlet when properly fixed. Ventilation of the room had been carefully and satisfactorily arranged by the patented injector ventilator principle. The radiant efficiency of the fires was extraordinarily good. The radiants used had a longer effective life than any other, and, therefore, cost far less to maintain. The secret was the extreme care taken in the selection, washing, and blending of the material from which the radiants were made, and in the special processes of moulding. When replacements became necessary, which was very seldom, it was found the radiants would always fit, because they never varied in size. The radiants were also recommended by their equal heating efficiency and their brilliant and pleasing appearance. The patent adjustable flue was also a marked advantage, and had a range from the horizontal to the vertical—making the fire, with its low flue height, a perfect fit for almost any coal grate. In design and finish the changes had been equally important. Many other developments had been made in domestic and industrial appliances generally; and the future was full of promise for the industry. He cordially joined with Mr. Slack in giving them a very hearty welcome.

After signing the visitors' book, the party was divided into sections and conducted round the works by Mr. Langford (Works Manager), Dr. Hartley (Chief Chemist), Mr. H. Sherburn (Foundry Manager), and Mr. W. H. Tickell (of the Accountant's Department), where the various processes of manufacture were seen from the foundry to the fittings shop, where the parts were assembled and the complete apparatus fitted up.

THE VISITORS AT TEA.

After some two hours had been spent in the works, the visitors returned to the offices, where tea was provided by the Company. After tea,

Mr. ALSOP said it gave him great personal pleasure to move a vote of thanks to the Richmond Gas Stove and Meter Company, Ltd., for their kindness to them that day. The Company were the genius of business procedure, adaptability, and as progressive as any firm with whom he had ever come into contact. The gas profession was indebted to them for the manner in which they had kept gas in the immediate foreground for so many years. The goods seen that day, compared with those of thirteen years ago, showed that the firm had been working on progressive lines—aiming at, and achieving, efficiency. He moved a hearty vote of thanks to Messrs. Thornton, J. W. Slack, A. Slack, and F. W. Richmond, and all those who had been their guides and helpers that afternoon.

Mr. J. T. HAYNES (Bolton) seconded, and said all had had the opportunity of seeing just what interested them most and in detail. He had been struck with the magnitude of the works; and when they thought that the simple cooker and gas-fire had built-up such an industry, it was very wonderful.

The motion was carried with acclamation.

Mr. H. M. THORNTON, in replying to the vote of thanks, said they were grateful to them for their visit that day. He thought the interchange of ideas and knowledge was bound to produce beneficial results. What they had seen that day would have shown them how rapidly the firm had grown; and it was still growing. The firm was a part of "Radiation Ltd.," which was comprised of seven or eight works almost as large as theirs. They had 10,000 employees, so the members would readily realize how very important a factor their business was to the gas industry. Radiation Ltd. were out to produce the finest article that could be made.

Mr. J. W. SLACK, in his reply, said he always liked to speak to the younger members of the profession. That afternoon reminded him of a Gas Students' Association at a works he was once engaged at, and what encouragement and help he had derived from being associated with it. He concluded by wishing the Association every success.

Mr. F. W. RICHMOND and Mr. A. SLACK also endorsed the appreciation expressed by other Directors of the Company.

THE BUSINESS MEETING.

Following tea, a meeting of the Association took place, when a paper was read by Mr. J. H. Clegg, of Burnley, entitled "Distribution and Commercialism." The paper was successful in producing a good general discussion; and the hope was expressed that further papers on distribution would find their place more frequently in the agenda of the Association.

DISTRIBUTION AND COMMERCIALISM.

By J. H. CLEGG, of Burnley.

[Abstract of a Paper read before the Manchester and District Junior Gas Association on Dec. 7 at Warrington.]

It has long been an axiom in the industry that the profits are made in the retort-house; and so far as the works solely are concerned, I am inclined to agree. One late member of our Gas Committee in Burnley had a frequent habit of endeavouring to instil into the minds of my chief and myself that what the people of Burnley require is first quality, secondly service, and thirdly price; and what applies to our consumers will, I think, apply to those of many other towns. The first-named essential we have found in late years can be destroyed by an inefficient distribution department, which means that, unless the second item, service, is complied with, the first essential deteriorates; also, the second item is in my opinion partly responsible for the third item, price. However good in quality our wares may be, if we do not sell largely and well, other factors being equal, price is bound to increase.

ORGANIZATION.

I regard the whole of the distribution department as the sales department. Our showrooms merely sell the apparatus—a means to an end, *i.e.*, the sale of gas—and for this department to be a success, it must be well organized. Opinions differ; and whatever ideas I may present I can only say that they are my own, and liable to be greatly criticized—rightly so, considering that, even at the present day, the opinions of our leading gas engineers are widely divergent, so widely that a junior who is attempting to use for his own benefit the experience and opinions of these eminent gentlemen is left hopelessly bewildered. Three years ago our technical staff in Burnley was so depleted through various circumstances that we had no distribution officials or foremen, and so we made a clean start in re-organizing. Instead of appointing, as is usual, one distribution superintendent for the whole department, with various subordinates, we decided to form a dual position. One official was placed in charge of all the distribution work from the station governors to the outlet of the meters, and another was appointed to take charge of all the work from the meter. Obviously, two different types of men were required; and we were successful in obtaining men whose qualities combined could not be obtained in one superintendent. Neither official has a foreman. The second official is also the showrooms manager; and before selling or quoting for any special apparatus pays a visit to the premises concerned, and afterwards supervises the fixing. Each section is keenly alive to the desirability of obtaining new consumers, and the installation of any apparatus which may be desired for the use of gas. By this method of control it is obvious that absolute unanimity on the part of the two officials is necessary.

After explaining in detail the allocation of the work, the author proceeded: As each job is costed quickly after completion, we are in constant touch with our work financially, and have no difficulty in estimating and fixing definite prices for prospective customers. Besides keeping all technical records with regard to our mains and services, we price out each job separately; so that we know what is our present rate per yard run for certain sizes, for comparison with records of previous years.

SELLING AND FIXING APPARATUS.

It has been conclusively proved during the recent period of industrial upheaval that not only is it necessary to manufacture our goods of the quality desired and as cheaply as possible, but that a market must be created for their disposal. We in Lancashire have suffered a loss in gas consumption by the cotton mills and other large industrial establishments working shorter hours than in pre-war times, and also from short time during bad trade. We are also experiencing strong competition in Burnley from electricity in lighting. The sum total of these losses compels us to increase our consumption in other directions. Otherwise, the price of gas must be necessarily increased; our standing charges being equal.

Now to attain this object! One of the principles of successful salesmanship is good and suitable advertising, which in our business I arrange according to the following methods. Firstly, efficient service; secondly, central showrooms; thirdly, "B.C.G.A." The work of the showrooms and "B.C.G.A." is useless without efficient service. Just a word about the showrooms. Personally, I have for some years favoured a central showroom; and my experience of the inauguration of two such establishments in different towns has strengthened this opinion. The showroom should be tastefully and artistically decorated, sufficiently to appeal to the æsthetic sense of the public, but not so elaborate as to scare away the working-class people, who, of course, take the bulk of our gas. The lay-out of apparatus should

be complete, and in actual working order, to exhibit the appearance and results which would be obtained by fixing in a well-designed house in a proper manner. The public should be invited to inspect the showrooms without pressure to purchase, and the use of the apparatus courteously explained in detail. The object should be to create a desire for the apparatus in the mind of the visitor, not necessarily at that particular time, but to so impress him that if at some future date he wishes to make any alteration in his house, then gas apparatus will surely form part of his scheme. I am speaking principally of gas-fires, radiators, circulators, geysers, hot-water apparatus, and high-class gas-fittings, designed to compete with electrical fittings.

My experience in competition with electricity for house lighting—for any other use we have nothing much to fear—is that expense is of little account if the consumer can obtain a high-class fitting (as he can for electric lighting), a burner which gives a good light, without trouble, no noticeable blackening of the ceiling, and a switch. The last has a great attraction. We are taking considerable trouble with this type of installation, which we provide and carry out ourselves, with the result that we have retained many lighting consumers who had intended to have electricity installed.

Cookers you will notice I did not mention, for in my opinion they are so well established, and their merits so well known, that they will sell themselves. So, I hope, will all the other specified apparatus at some future date, when we have our foundation well and truly laid, and if assisted by gas apparatus manufacturers turning out scientifically and reliably constructed apparatus at cheaper than present-day prices. Prior to the war so much damage had been done by the fixing of unhygienic gas-fires, that a considerable prejudice was fostered against them, especially by people who had actual experience of them fifteen to twenty years ago.

At the conclusion of the war, we commenced to push gas-fire sales; and as the makers of apparatus had not commenced their enterprise in this direction, we fixed a few fires in the showrooms with tiled surrounds, wherever we had access to a flue, connecting up the fire with polished brass tubing bent symmetrically, and brass floor cock, which were afterwards lacquered. We attached a price card, and made known the fact that we were prepared to fix fires complete as shown for a definite sum. At the present time, we take out ranges or register grates, build up the opening, tile a surround and hearth, fix a mantel, patch up broken plaster, do papering and painting, and fix the fire in a thoroughly satisfactory manner at practically cost price. We keep the necessary tradesmen on the works, and they are drawn upon as required. The first dozen or so which we fixed on the above lines lost us money, if we took into account the time spent on canvassing, supervising, and ensuring satisfaction. These were chiefly fixed in the surgeries and waiting rooms of doctors and dentists; and the sympathies of speculative builders and architects were enlisted. The result has been that each of these fires has brought in large numbers of orders, and they, in turn, when completed, continued the process. We also specialize the work of fitting—*e.g.*, one man is employed solely in fixing gas-fires, certain men fix gas-cookers and wash-boilers, and a plumber is kept on hot water work of all kinds. The result is that these particular men, once used to our requirements, do their work satisfactorily with little supervision, and with greater speed. The advantage to the consumer by adopting the above methods is apparent, as we take the responsibility throughout. We extend our thoroughness to the fixing of all appliances, and are prepared to tackle anything which is necessary to the fixing of these appliances—*e.g.*, taking out a kitchen-range and replacing by an all-gas set, in a tiled alcove. Another advantage to the consumer is that he knows exactly what the job is going to cost him beforehand. We have recently undertaken complete heating installations at our local Open Air School, and in other large buildings, after competitive tender, either by gas-heated water circulator or by coke boiler. If we cannot sell the former, we sell the latter.

Our business is divided into three classes—direct purchase, hire purchase, simple hire, on the following terms:

Direct Purchase—10 p.ct. on cost price, *plus* a flat rate of 10s. for fixing. Fixing means, of course, fitters' work and fitters' materials. If other work is required, a special quotation is given. For fixing domestic water-heaters, a flat rate of £2 is charged, to cover all labour and materials for gas and water.

Hire Purchase—A further 10 p.ct. on the selling price, *plus* fixing charge, divided into twelve quarterly instalments.

Simple Hire (chiefly new apparatus)—The rent charged is 15 p.ct. of the sale price, *plus* fixing charge, per annum. A deposit of 5s. is required to ensure the consumer retaining the apparatus for twelve months. This deposit is returnable at the end of twelve months, *plus* interest. We do not encourage simple hire; and we do not find that this policy in any way retards our business, as we generally induce a customer to buy his apparatus.

Preferential Rates.

The consideration of preferential rates is a matter entirely for the individual town; and we in Burnley have recently adopted preferential rates for all domestic purposes other than lighting. Where the consumption for this purpose is not less than 10,000 c.ft. per quarter, we give a rebate of 4d. per 1000 c.ft.; for not less than 100,000 c.ft., 6d. per 1000 c.ft. Our charge for power purposes is 3s. 10d. per 1000 c.ft. These rates have been instrumental in obtaining for us extra gas consumption, in the way of cookers, fires, water-heaters, and heating systems. For rebate purposes, we use rotary meters, which are sufficiently accurate for that purpose. Of course, if any alteration in piping and meter fixing is required, this is charged to the consumer.

Maintenance.

A maintenance department is considered by some gas engineers to be a luxury. This is again a matter for individual consideration. We have had one for the last three years, and have had no occasion to regret it. We attend to any gas apparatus on application, charging only for materials which may be used. This money is received by the maintenance man, who issues a duplicated official receipt. For large premises we have yearly contracts, charging a flat rate for periodical inspection and cleaning, inclusive of all materials. The benefits to be derived are: (*a*) Satisfaction to the consumers, thus enabling us to compete with electricity; (*b*) the ensuring of the use of apparatus already installed; and (*c*) the obtaining of new orders.

Mains and Services.

Burnley is generously laid out in this direction; it being our practice to ensure an ample supply of gas to the consumer by laying fairly large branch mains and services. It has always been the practice in Burnley to charge the landlord for services. The out-districts are boosted during the hours of maximum consumption, by specially laid high-pressure mains, through Reynolds governors.

Meters.

As I stated during a discussion at one of our meetings last year, Burnley has for years installed only wet meters. On that occasion I gave figures to show that it was a financial proposition. Further, we derive a great benefit in the way of low "unaccounted-for" gas. We repair almost all our own meters, and find that it pays us to do so.

Street Lighting.

We carry out the public lighting on the yearly contract basis; and here may I point out that efficient street lighting is a good advertisement, especially if high-pressure lighting is in vogue in the centre of the town. However, in these days of lower calorific value, the consumption per lamp must be carefully checked, and supervision of the lamplighters in respect of their times of commencing to light and extinguish must be thorough, or here will result an inflated "unaccounted-for." We pay all capital charges with respect to street lighting, but a certain sum is charged per lamp per annum in addition to the contract price, irrespective as to whether the lamp is lighted or not, to cover ourselves. We are extending our use of controllers, as a considerable saving is effected, although even the best of them are not thoroughly reliable. I may mention here that Burnley is the possessor of an old time legacy in the form of a special maximum lamp rate, which was 6d. in the pound until 1919, when powers were obtained to increase that maximum to 1s.

Gas Regulation Act.

One of the most important steps affecting the Distribution Department commercially has been the introduction of the Gas Regulation Act, 1920. Whatever our private opinions of low calorific value gas, the bulk of town councils and influential bodies of consumers have viewed the reduction with apprehension. In Burnley, the local Chamber of Commerce has constantly urged us to maintain a standard of 500 B.Th.U. gross. What is the best quality to manufacture and distribute is still a question of discussion among gas engineers. The adoption of this Act has tended to modify the partiality for low-grade gas, for in such a case there is no tangible reason why a gas should be distributed of lower calorific value than that at which it can be the most cheaply manufactured. The unit of therm will allow a sensible comparison between gas undertakings, and, better still, will ensure the gas consumer obtaining a known value for his money. We all know from experience how suspicious the gas consumer is, and even now his opinion is that the alteration is a cloak for increasing the price of gas. In a number of cases where maximum prices have been fixed by a Special Act, the opportunity has been taken to obtain an increase in that price; but this would have been necessary in any case. In time, however, the consumer will find the advantage to himself by buying on a heat unit basis.

Conclusion.

Each of the above headings on which I have lightly touched could in itself be the subject of a paper, but, strange to say, in our Association, distribution papers in themselves have, for some unknown reason, been scarce; and even the bulk of those cover some aspect of mainlaying or naphthalene troubles only purely technically—scarcely a thought being given to the purely business side.

DISCUSSION.

Mr. PAYNE (Liverpool) said he was of the opinion that wet meters only became short of water when overworked. As regards gas and electricity, they in Liverpool supplied gas of 450 B.Th.U. calorific value, and electricity was three times as dear as gas for lighting; gas was five times cheaper for power purposes; while for cooking it was eight times cheaper. He thought gas departments might make more use of the visits to the consumer, seeing that each was visited no less than four times a year.

Mr. R. H. GARLICK (Salford) spoke for greater organization in the distribution department, and gave details of their methods, including the card system, registration of complaints, &c.

Mr. J. T. HAYNES (Bolton) pointed out that greater care should be exercised by meter inspectors in the watering of the meters. In some cases the water was taken from one meter and put into another, and this was done all through the day; whereas clean water should be used each time the meter was replenished. This would almost entirely eliminate the formation of sludge that had been found in some meters where this bad practice prevailed.

Mr. J. BRIDGE (Elland) pleaded for a greater interest in distribution matters, particularly so by those members who were not in the department, as it was being found, chiefly in the North, that this department had not quite kept pace with the increased gas consumptions caused by the introduction of gas cookers, fires, &c., in almost every consumer's premises. The distribution department was a great asset to the manufacturing side; and they must work together more, as it was no use making gas if the arrangements were not complete at the distributing end of the profession. Another point which was not quite satisfactory was that the street lighting was often in the hands of others, who were not at all interested in the manufacture. Here, again, was a lack of continuity.

Several other members contributed to the discussion.

Mr. H. M. THORNTON (Richmond Gas Stove and Meter Company, Ltd.) emphasized the importance of having ample gas service, so that any apparatus supplied should be able to give the desired efficiency. He thought the gas consumer was rather lacking in the necessary knowledge to get the best out of the apparatus with which he had been supplied. He also spoke about the splendid work done by the advocating of the British Commercial Gas Association and Radiation, Ltd. They were all doing what they could to educate the public in gas matters.

Mr. SLACK (Richmond Gas Stove and Meter Co., Ltd.) referred to the number of bad services and small mains that he had come across, showing a need for improvement in this direction.

Mr. HORROCKS (Chief Representative of the Richmond Company in Lancashire and Yorksshire) dealt with the importance of good work being done by gas-fitters.

The PRESIDENT, in closing the discussion, stated that as the time was very limited he would confine his remarks to emphasizing the stern necessity for many undertakings to put their distribution departments on a sound basis. The question one should always ask himself is: Are we giving an efficient service? If not; then find out what is wrong and put it right. No matter what propaganda is undertaken, efficiency of service and the satisfaction of the consumer is the best advertisement. There were a number of interesting points in the paper which one could very well criticize and discuss; but, owing to the lateness of the hour, he would call upon Mr. Clegg to reply on the discussion.

Mr. CLEGG briefly replied to the various questions that had been asked.

Mr. DEAN (Altrincham) moved, and Mr. W. N. H. SMITH (Darwen) seconded, a vote of thanks to the author for his paper, and this concluded the proceedings.

SCOTTISH JUNIOR GAS ASSOCIATION.

(WESTERN DISTRICT.)

Mr. ARCHIBALD WYLIE, Chief Distribution Clerk in the Glasgow Corporation Gas Department, read a lengthy paper on

COMPLAINTS AND INQUIRIES.

The author explained that he had compiled the paper with the object of explaining a few of the problems that daily present themselves to his department, and how these are treated. In a Complaints Office, the problems presented to, and elucidated by, the staff are many and varied; and therefore he advanced the plea of training men to fill these positions with greater efficiency than at present. The object in having a Complaints Department is to give facilities to consumers who have a grievance, whether real or imaginary; and this section should be in the care of officials who have a thorough working knowledge of gas distribution in all its branches. In dealing with the public the attendant should be able to give a satisfactory reply to their queries. In fact, he should be a "Gas Industry Encyclopedia." From a departmental standpoint, the opportunities afforded to a Complaints Department staff are unique, and should be taken advantage of to a greater degree than at present. Analyzing the figures for the six months ended Oct. 31 last, he said they were infinitesimal.

At present the complaint order is in triplicate, and is used for all classes of repairs, cut-off and turn-on supply, meter readings, and fittings work. They are numbered consecutively, with a special distinguishing mark for each issuing department. The first flimsy remains in the book, which holds 400 complaint orders, and serves as the permanent record. The second flimsy and the card are sent to the workshops, surveyor's department, or showrooms for attention. On arrival at the department where the work has to be done, the inspector retains the flimsy, and serves out the card for attention. On completion, the card is returned to the Complaints Department, where it is scrutinized and passed to the surveyor's department, so that the list of appliances detailed thereon by the inspector or workman is checked with present records; and, if correct, the card is returned to the Complaints Department for filing purposes. Periodically an inventory is taken, and all missing cards noted and traced. This involves a great deal of work; but it guards against any complaint being overlooked, and acts as a stimulus to get through this class of work in an expeditious manner. It also serves the purpose of tracing appliances which are sometimes taken by tenants to their new addresses when removing; and many instances could be given of our appliances being traced by means of the humble complaint card.

On receipt, the complaints are sectionized as follows: Removals, meter and piping escapes, auto repairers and collectors, general complaints (want of gas, &c.), and appliance complaints. In the case of general complaints, the type of meter in use is verified. This is done by the survey department staff. The workman sent to repair should make sure that the meter in use is large enough for requirements; or the service may be too small. Dealing with the proper sifting of complaints, he emphasized the benefits that may be derived from the manner in which one addresses the consumer. It should always be remembered that if information desired from consumers is asked for in an "interested" manner, it will be given spontaneously. The information is of great service in locating the root of the trouble. On many occasions cases of obsolete appliances are discovered in this way; and this presents an opportunity. Carefully note these instances for the attention of the sales staff, always provided the order cannot be clinched at once. The sales staff are there for this purpose, and will be found ready at all times to assist. This is where the usefulness of technical knowledge becomes apparent, and has room for development. Should complaints be received from any particular district, it is the duty of the Complaints Department staff at once to apprise the management.

The Complaints Section should be able to keep a finger on the pulse of the department. This can be best accomplished by means of graphs and charts, which should prove of service to the management. In the case of complaints, the chart should show the rise or fall, and the particular kind of complaint most prevalent each day. If the increase is confined to a certain district, it is invaluable to obtain this information as it occurs, as steps will at once be taken to ascertain the cause.

The graph is also used for meter and appliance stocks, motor transport, meters and appliances fixed and in use on the district, records of work done, allocation of work, and meter and stove repairing costs. Perhaps meter exchanges on the district show a decided increase on the graph. It is confined to one section; and steps are immediately taken to find out what is wrong. Stocks of appliances are increasing according to the graph. On inquiry we find, perhaps, that a great many obsolete types of fires are being brought in from the district. Transport costs sent in from several departments show variance. This is possibly due to special runs required, and the transporting of heavy appliances.

Looking to the future, the author said he hopes to see the day when complaints shall have become a thing of the past. Perhaps this is idealistic; but the fact remains that a very large percentage of the complaints lodged at the present time might have been obviated. Most of the complaints received are regarding want of gas, or requesting overhaul of appliances. To a consumer, the first-mentioned complaint is very annoying, and should receive careful and prompt attention. The trouble is caused chiefly through rust in the mains and inadequate supply pipes. The rust is a war-time legacy, and may be called "the aftermath of naphthalene." Solvents are of no use in removing the stoppage, and, if applied, would have the effect of gathering-up the rust into a solid mass, which would have an even more distressing result. A service cleanser which compresses air up to 300 lbs. per sq. in. is used for the purpose of removing rust.

The other trouble is due to the smallness of service-pipes, particularly in tenement buildings. A great many closes in Glasgow are fitted with ½-in. to ¾-in. stair pipe; and from this pipe it is common to supply ten to twelve houses. Roughly speaking, the capacity of ½-in. pipe at (say) 30-10ths pressure is 90 c.ft. per hour. To give an adequate supply, this property would require at least a 1½-in. service; but the factor will not move in the matter, even though repeated complaints are being received from the tenants. In this case, the cost of renewal would amount approximately to £23. Without entering into a controversy as to who should assume responsibility for such a state of affairs, it should be understood that, once a service-pipe is led into a building or tenement, it becomes part of the property. The attitude of the department up to the present is to insist on the proprietor's contributing to the cost of a new and larger service-pipe capable of supplying the requirements of the tenants; but the author is convinced that, until they execute this work free of any cost, there is little hope of pushing business, at least in tenement properties.

It must not be forgotten that in the smaller sized houses *pro rata* there is more gas consumed per annum than in the self-contained and larger houses. The following figures go to prove that no effort should be spared to encourage the masses in the proper application of gas for all domestic purposes. The figures in connection with ordinary supply are taken from 1000 consumers, and 400 consumers in the case of automatic supply. They are representative of the working middle class districts in the city, which are very good customers of the Gas Department

With Ordinary Meters.

Name of District.	Average Consumption in C.Ft.
Dennistoun	46,654
Pollokshields	68,477
Hyndland	34,909
Govan	13,316
Maryhill	16,561
Calton	10,610
Kelvinside	69,914
Giffnock	40,051
Rutherglen	14,477
Clydebank	18,714
Ten districts, average	33,288

With Automatic Meters.

Name of District.	Average Consumption in C.Ft.
Partick	17,348
Govan	17,879
Bridgeton	15,098
Clydebank	19,068
Four districts, average.	17,348

In the past, the clerks in the gas department have been neglected; and their abilities are often under-estimated. A word of encouragement in season is acceptable and appreciated. It is greatly to their benefit to be able to discuss gas matters correctly. It is not sufficient in these strenuous times to interest ourselves only in matters pertaining to our particular section; but it is up to us all to gain knowledge—particularly in the fundamental rules governing gas supply—and to understand how gas is made and distributed. All members of a gas department clerical staff should take the necessary steps to acquire this knowledge.

After some advice to the young man in the gas industry, and especially those in a Complaints Department, the author went on to advance the plea of recognition of usefulness to the staff engaged on complaint work. There is, he urged, no section of the department more vital to smooth working; and it certainly presents the best possible training for the young man who afterwards may seek to come into contact with customers in their own homes or places of business.

Mr. Wylie's idea of a Complaints or Inquiries Department is that:

1.—It should be staffed by employees who have been trained as salesmen, and have a good working knowledge of distribution matters, such as meter reading and workshop practice.

2.—Gas lighting should be fitted-up attractively in the department, and every facility offered to ensure the consumer's being attended to promptly and efficiently.

3.—The complaint particulars should contain as full information as possible, so as to avoid second visits.

4.—All post complaints should be written out on receipt by a staff who are able to condense into a few words the meaning the consumer wishes to convey.

5.—By centralizing the work in this section, the management has the opportunity of watching events from all branches of the sales and distribution departments, and of reorganizing when required.

A wise step would be the extension of branch offices to districts at present unserved. These sub-offices could be given a central position, so that each would serve a small town, and be utilized for all work in connection with the department. Their utility would soon become apparent; and, forming part of bright and attractive showrooms, well-stocked with up-to-date appliances and fixtures, they would prove successful.

SCOTTISH JUNIOR GAS ASSOCIATION.

(EASTERN DISTRICT.)

Visit to Cowdenbeath.

Mr. JAMES J. SCOTT (the Engineer and Manager of the Cowdenbeath Gas-Works) read the following paper, entitled

DEPOSIT IN STEEL PIPES.

In deciding to deal with the question of deposit in steel pipes, I only intend to put before you some particulars of my observations and experience of it. This trouble is fast becoming a perplexing one to the industry and equally so to the consumer—to the industry because of its possible far-reaching effects on the life of steel pipes and meters, and incurring heavy costs in the cleaning and relaying of service-pipes, also repairs to meters; and to the consumer because of the irritation and discomfort caused by the gradual reduction in volume and pressure of the supply. In its behaviour it is like a cancerous disease, eating its way in, slowly and surely, until it overcomes, giving no indication of its whereabouts until the consumer lodges a complaint about no pressure, poor light, &c.

The first indication of deposit occurred in the low-pressure services about 1912. It was then thought that it was an accumulation of loose substances in the tube; but as choked services became a new form of complaint, occurring in different parts of the district, a suspicion was cast on the quality of the tube used at some particular time. To probe this suspicion, the services affected were traced to the date of laying; but no connection could be applied, as the dates covered too great a period. Perhaps I should state here that all service-pipes are of steam-quality steel tube; and our practice has always been to lay nothing less than ¾ in. bore into the ground, even to the smallest consumer. During the year 1913, after the deposit trouble had established itself, a new set of purifiers was put into operation, consisting of four boxes, 20 ft. square by 5 ft. deep, on downward flow and backward rotation, with a change-over weekly, to replace three boxes of 12 ft. square by 3 ft. deep in downward flow and forward rotation. The deposits still continued; and early in 1917 a sample was obtained for analysis, with the following result:

	P.Ct.
Prussian blue	2·00
Peroxide of iron	58·46
Protoxide of iron	12·81
Silicious matter	5·20
Lime	0·96
Magnesia	0·08
Sulphuric acid (combined)	2·64
Combined water, &c.	17·30

In view of the large percentage of oxide of iron present, the question then presented itself: Was this going forward from the purifiers, or was it internal corrosion of the tubes? Dealing with the first part of the question, "Ferrox," "Bog Ore," and "Lux" were the purifying agents in use, both in the old and the new purifiers; but it was observed that (perhaps by coincidence) when Lux was last in rotation, the choked services were more numerous. It was argued, however, that if oxide was going forward from the purifiers, was it not possible that the wet surfaces of the station meter and gasholders were a trap for it, and likewise the wet surfaces of the main pipes and drip boxes. Previous to 1906, lime was used entirely as the purifying agent. Fortunately, I was able to have the opportunity of following up this view, as in 1918 the station meter and governor were replaced by larger ones. A careful examination was made of both during dismantling; but no indication of accumulations of deposit was found in the case or even on the meter drum, which appeared to be in very fair condition. Likewise, the governor gave no indication of having arrested any deposit.

During the past summer No. 2 gasholder was put out of action, and the tank emptied to allow of a third lift being added. Here, again, careful inspection was made to see what the condition was. On the holder sheets and roof work could be seen quite distinctly the original erection marks in white lead; while a loose scale adhered to the plates, and principally round the rivets, all of which was easily brushed off, leaving the surface of the sheets smooth and the hammer marks on the rivets quite distinct. Owing to the external corrosion of the bottom ring of sheets at the wind and water line, these were renewed.

Regarding the tank, there was found a small accumulation of deposit round the rest blocks and angle, varying in depth to about 2 in. On the tank sides a scale or deposit was apparent, especially on the top ring of plates, but on those further down very little, which was removed by brushing. I might mention here that I had the inside of the gasholder and tank painted with "Humidine" in an endeavour to afford in the future every protection possible to the metal.

I took samples of the deposits from the holder and tank, and had these sent to Mr. Gemmell, of Edinburgh, the Official Analyst to the North British Association of Gas Managers, along with a sample of deposit from the high-pressure main pipe extracted at Crossgates. The following results were obtained:

—	Gasholder.	Tank.	H.P. Main.
	Per Cent.	Per Cent.	Per Cent.
Water	4·3	3·30	5·2
Loss on ignition	16·6	18·10	16·1
Mineral matter	79·1	78·60	78·7
The mineral matter consisted of:			
Insoluble in acids	1·5	1·4	2·5
Ferrous oxide of iron	4·9	4·3	5·0
Ferric oxide of iron	72·0	66·2	68·3
Lime	0·5	0·9	0·7
Alkalis	1·2	1·2	1·7
Carbonic acid (combined)	3·2	0·0	0·8
Sulphuric acid ,,	0·1	0·1	0·2
The loss on ignition consists of:			
Oil	0·26	9·88	2·10
Sulphur	0·74	8·46	8·80
Tar	0·00	0·00	0·00
Prussian blue	5·75	3·05	3·46
Thiocyanate of ammonia	0·00	0·00	0·25

The analyses offer several points worthy of consideration—such as their general similarity, the variation of the oil and sulphur proportions, also the Prussian blue content of each. With regard to the second part of the question set, the possible effect of free oxygen in the gas may be considered; and I am open to believe that a certain amount of the trouble originates here. Oxygen in the presence of moisture does cause oxidation; but I am of opinion that all the deposit which accumulates is not entirely due to free oxygen.

Then, again, the extraction of light oils from the gas during the war period has been credited with offering an opportunity for corrosive action, due to the stripped gas replenishing itself from the oil coating on the interior of the pipes. Here I find that observation discounts this theory, because our trouble with deposits commenced in 1912, and gradually increased each year; while working on the cast-iron mains in the district again gave the opportunity to observe that the oil film was still there, and recent operations still indicate its presence. I am favourably impressed with the view that cyanogen in the gas, by its action, direct or indirect, has a great deal to account for in this matter.

About two years ago, the deposit question was taken up with Messrs. Parkinson and Taplay, who are engaged on research work on behalf of the Life of Gas-Meters Committee, to whom samples

of the deposit were sent; and the following are the particulars of these tests:

ANALYSIS.

—	Deposit from Syphon on H.P. Main.	Deposit from 1-in. L.P. Service.
Colour	Brown	Brown
Reaction to litmus	Neutral	Neutral
Loss on drying at 100° C.	1·60 p.ct.	3·50 p.ct.
Tarry matter	0·80 ,,	1·40 ,,
Sulphur	1·70 ,,	3·70 ,,
Ammonium thiocyanate	0·05 ,,	0·02 ,,
Ammonium sulphate	0·01 ,,	0·07 ,,
Ferrous sulphate	0·00 ,,	0·00 ,,
Calcium sulphate	0·00 ,,	0·00 ,,
Ammonium ferrocyanide	0·00 ,,	0·01 ,,
Ferric ferrocyanide	1·00 ,,	5·00 ,,
Ferric oxide and triferric tetroxide	89·50 ,,	82·90 ,,
Aluminium oxide	0·00 ,,	0·00 ,,
Calcium carbonate	0·01 ,,	0·18 ,,
Silica	3·66 ,,	2·45 ,,
Carbon	0·84 ,,	—
Total	99·17 p.ct.	99·23 p.ct.

The deposit from the high-pressure main was taken on the first indication of its presence; while the low-pressure sample was taken from a 30-ft. length of pipe which had been in use twelve years, and was found to be solid from end to end. From the correspondence which took place, Messrs. Parkinson and Taplay were of opinion that hydrocyanic acid was the cause of corrosion.

Fully a year ago we began to experience trouble with our high-pressure main going to Crossgates and Aberdour—a distance of about 6 miles. On one occasion we were completely held up, very little gas passing indeed; and the higher the pressure, the less gas. Pressures were taken on the pipe line, and at a point about a mile from the works we located the trouble. This was not rust, as I had expected, but a joint which had been drawn, due to underground workings; the yarn having folded into the pipe and acted like a sponge by absorbing the oil which had come forward with the gas from the compressor until it had practically blocked the pipe. The point here I wish to bring before you is the fact of the oil protecting the pipe up to this point, over which section we have never had any trouble.

This is clear evidence of one way in which the trouble may be prevented; and I have not proceeded with oil spraying the gas because of the fear of fixing existing accumulations of deposit as permanent obstructions in the pipes at unknown points. If one could get all deposit removed, then oil-spraying would be beneficial. But this method of treatment is only palliative, and does not get to the real prevention of the trouble, which to my mind will require treatment at the gas-works.

If hydrocyanic acid is the origin, then the treatment must be for the removal of this; and I refer you to the many valuable articles in the Technical Press from these gentlemen during recent months, and especially the report submitted by them to the Institution of Gas Engineers in October last, and also a statement in the Press*, giving particulars of a method of extracting the hydrocyanic acid from the gas by means of chalk purification. The splendid work done by Mr. Taplay in this subject deserves great praise. The removal of cyanogen has always been too costly from the commercial point of view; but if, of necessity, it must be removed to eliminate the trouble to pipes and meters, then I view it in the light of a very good commercial proposition. Whatever the form of treatment may be, however, it will be slow, and several years must elapse before one could be confident of being free of the trouble. In the meantime, the ordinary methods of removal must be continued.

A short piece of steel tube was cut off the high-pressure main at Crossgates, at a point where we found accumulations of deposit, for examination; and a loose scale was adhering to the pipe all over its surface. The cutting, along with a sample of the deposit, was sent to the makers of the tube for their examination and opinion: and I am favoured with their permission to express their views. They say:

> We have made qualitative tests of the deposit, and find it is composed of oxide of iron (chiefly), with various amounts of cyanides, tarry matter, sulphur compounds, and silica. The latter was estimated, and was found as high as 4·50 p.ct., while the deposit contained numerous grains of free silica. Microscopical examination revealed crystals of ferro-cyanides, also a white organic compound, probably naphthalene.
>
> We have carefully examined the tube itself, after cutting it up, and find the surface perfectly smooth, the deposit very loose, with no trace of pitting, also the tube shows no wearing away, such as we should expect from the amount of deposit present.

In later correspondence they advised me of a small experiment that they made by inserting into their gas-mains two small pieces of bright or polished steel tube. In one main was suspended a piece of potassium cyanide preceding the piece of steel; while in the other it was free from cyanides. After seven weeks the two pieces of steel were removed, and it was found that the piece subjected to the influence of the potassium cyanide had a coating of a bluish shade, indicating the formation of ferrocyanide, while the other tube was perfectly bright. Such a report is of great interest, and indicative of cyanogen having some action on steel.

* See "JOURNAL," Sept. 14 last, p. 589.

The whole subject is very difficult, and resolves itself into a chemical proposition requiring the very best brains of the industry to deal with it. Progress is being made towards the means of prevention; and while a definite treatment may soon be available, there is still the problem of dealing with existing deposits.

Our method of dealing with the high-pressure pipe is to remove all the governors and apply an air blast of about 15 lbs. per square inch for several hours, which is very satisfactory; while in regard to low-pressure service pipe, the ordinary methods of cutting and rodding, or blasting, are adopted.

Regarding wet rust, there is only one remedy—that is, to lift and relay.

With reference to the effect on meters, I have refrained from entering into this subject; but I would state that we have had no serious trouble so far.

THE GAS INDUSTRY AND APPLIED CHEMISTRY.

By H. D. MADDEN, Chief Engineer to the Cardiff Gas Company.

[From an Address to the Cardiff Technical College Chemical Society.]

Prior to the war, public interest in chemistry was slight, and the national value of chemistry was very dimly understood. During the conflict of 1914-1918, chemistry and the sciences developed at a rapid rate, receiving national benediction and approval; and chemistry really came into its own among the sciences of the country. When the German armies came across the French borders, few, if any, of the people of this country appreciated the part the chemists and chemical engineers would play in the nation's offensive and defensive operations. Stress is laid upon this, not because chemistry had a war-time benediction, but because of the desire to emphasize how far-reaching a part chemistry plays in the ramifications of our life and business pursuits.

One can hardly conceive of any works of the future making progress without the aid of chemistry; and the knowledge of this fact is rapidly gaining ground. A well-known gentleman mentioned to me a few weeks ago that, had he a personal knowledge of chemistry, he could multiply his business and cater for materials in many directions other than, and in addition to, that which he is now doing. He said he could not fully realize, owing to his lack of knowledge of chemistry, the vast possibilities of his business. There are golden opportunities in the future awaiting the chemists who are being trained to-day. Much wider and more remunerative posts will be open as the knowledge of chemistry is appreciated by the general public in forthcoming years. The ball is at the feet, so to speak, of those who are receiving modern training at our colleges.

For a number of years, the science of chemistry has been introduced into the daily routine and research of gas-works; and never was it utilized more than during the dark days of the war. When the late Lord Moulton was made Director of Explosives, he stated on more than one occasion that he realized that the war could only be won if the resources of the gas-works of the kingdom were placed at his disposal. The Government passed an Act which made it incumbent upon every gas company or undertaking to supply the needs of the High Explosives Committee in whatsoever manner they prescribed. I had the honour to serve throughout on the Sub-Committee for Wales for High Explosives. How far the chemists of the gas and bye-products industries went, there is no need to dilate on. The supply of explosive materials surpassed Germany's; and we ultimately had more than ample quantities for our guns.

We, as an industry, are attaching more and more importance to chemistry practically applied to the daily routine of manufacture; and we are not alone, because all industrial works are discovering, day by day, how much they owe to the sciences and the value of the works chemists. With the advance of the importance of the works chemist, a new branch is being opened-out for students—namely, chemical engineering. In fact, I consider it advisable for every chemist to have some knowledge of the engineering side, so that he can combine his chemistry and fit himself for this new requirement. The treatment of gas, tar, and ammoniacal liquors each resolves itself into a large chemical problem; and in regard to tar, its potentialities are so vast that only the outside edge of the field has been really touched. The synthetic problems open such an avenue that there are possibilities of very great chemical discoveries hidden away in that black common liquid called tar. The future of fuel, and the large conservation of raw materials, are in the hands of the budding chemists and chemical engineers. If they rise to the occasion, Great Britain will resume her place as a nation foremost in the arts of engineering and sciences and industry.

Society of British Gas Industries.—The Secretary (Mr. Arthur L. Griffith) forwards us a copy of the Rules and List of Members which has just been issued. There are now 125 firms in the list. The new President is the Right Hon. Lord Riddell of Walton Heath; and to the names of Vice-Presidents that of Sir Arthur Duckham, K.C.B., has been added. The Chairman of Council is Alderman George Clark, and the Vice-Chairman Mr. Albert Cliff. The Hon. Treasurer is Mr. H. M. Thornton, and the Hon. Secretary Mr. F. J. Gould.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Three-Rate System of Charging.

SIR,—An editorial in the "JOURNAL" for Nov. 9 refers to the statement made as to the "three-rate system of charging" by Mr. G. M. Gill, in his address on the gas business in the United States, delivered to the London and Southern District Junior Gas Association on Oct. 28. It may be interesting to you to know that, while the equity and justice of a three-part gas rate are universally recognized in the United States, very few gas companies have such a rate in effect as an obligatory one applying to all customers, though there are many cases of optional rates of this character which can be taken advantage of by large customers. Usually when a departure has been made from the one-part rate for gas, it has been made in the shape of a fixed customer or service charge, which is independent of the amount of gas consumed, *plus* a charge per 100 c.ft., or per 1000 c.ft. of gas used, which is lower than it would be if a service charge were not made.

Considerable opposition has been experienced from customers in some cases in which such a two-part rate has been put in force; and recently the fixed charge has been made in another form. This consists in charging from $0.70 to $1.00 for the first 100 c.ft., or less, of gas, with a smaller charge per 100 c.ft. for the additional gas, consumed in any one month. One of the gas companies in Connecticut has recently entered into an agreement with the municipal authorities under which a two-part rate, consisting of a service charge of $0.35 per month and a price of $1.80 per 1000 c.ft. for all gas consumed, has been changed to a rate of $1.00 for the first 100 c.ft. of gas, or less, and of $0.14 per 100 c.ft. of all gas consumed in excess of 100 c.ft. per month. For some reason or other, a rate of this kind, while being practically the same as a straight two-part rate, seems to be much more acceptable than the latter to gas consumers.

It is very well recognized in the United States that a gas company's full duty to its community requires the supplying of gas at low prices for industrial uses, and that this cannot be done unless the many consumers of small amounts of gas who are unprofitable under a one-part rate can be made to pay the full cost of the service received by them through either a two-part or three-part rate, or a rate such as that named above, under which a price covering the fixed costs is charged for the first 100 c.ft. of gas consumed per month.

15, *Park Row, New York, Dec.* 1, 1921. ALFRED E. FORSTALL.

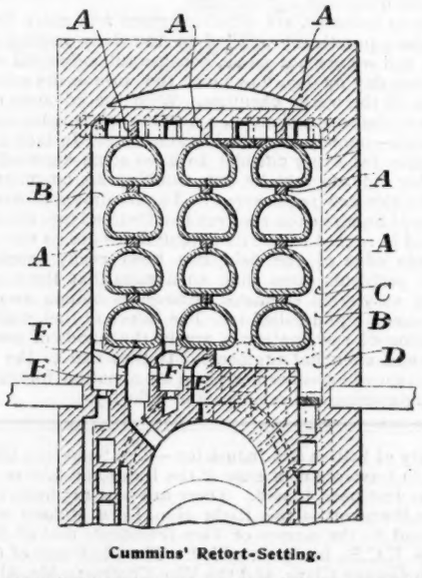
REGISTER OF PATENTS.

Inclined or Horizontal Retort-Settings.—No. 171,148.

CUMMINS, F., of Manchester.

No. 22,952; Aug. 4, 1920.

According to this invention, in an inclined or horizontal gas-retort setting of the regenerator type, and having a plurality of superposed rows of retorts, the interior of that part of the setting where the retorts are situated is divided lengthwise and crosswise into a plurality of independent substantially vertical shafts, all of which have their outlets at the top, and being separately supplied with heating gas and secondary air. The shafts preferably extend above the top row of retorts, and are formed by walls extending in the longitudinal direction of the retorts and walls extending transversely of the retorts; and the outlets of each longitudinal row of shafts open into a separate flue at the top of the setting, in connection with which a damper is provided. Thus each longitudinal row of shafts can be controlled independently of the other longitudinal rows.



Cummins' Retort-Setting.

An important feature of the invention consists in providing directly beneath each bottom retort a longitudinal chamber adapted to be supplied with heating gas only, and at each side of the chambers a longitudinal chamber adapted to be supplied with secondary air, and in open communication with the heating gas chambers and each shaft. Thus an independent stream of burning gas is supplied to each of the shafts, and the retorts are uniformly heated.

In the illustration, the setting at each side of the central wall is divided by walls A and crosswise by walls B into independent vertical shafts, and the former are extended upwardly beyond the retorts to form four independent horizontal flues into which the outlets of the vertical shafts open. A damper is provided for each horizontal flue whereby each longitudinal row of shafts can be independently controlled. The separate flues open into four down flues C immediately behind the walls from which the retort mouthpieces project, and the flues are joined at a level below the lowest of the retorts into two flues D, each of which is controlled by a damper, whereby two longitudinal rows of shafts can be controlled jointly but independently of the other two. In each of the horizontal flues is preferably arranged a damper whereby two or more shafts of each longitudinal row nearest the centre transverse wall can be regulated independently of the other shafts.

Directly below each retort of the bottom tier a chamber E is provided substantially parallel with the retort and connected at one or more points along its length with the producer gas supply. These chambers are not supplied with secondary air, and therefore combustion does not take place therein as hitherto. At each side of the chambers is a secondary air chamber F, running substantially parallel with the retorts, and each situated beneath one of the longitudinal rows of shafts and forming a common extension or continuation of one longitudinal row of shafts. The bottom of each chamber F is provided with secondary air inlets the number and distribution of which correspond with the shafts in the longitudinal row below which the chamber is situated, and openings are provided from the chambers E to the chambers F, corresponding in number with the air inlets and being preferably situated near the roof of the chambers F. The gas and air therefore meet and mix in the chambers along their whole length, and form upward streams each of which enters one of the shafts, whereby uniform heating of all the retorts and all parts of each retort is ensured.

Destructive Distillation of Carbonaceous Substances. No. 171,152.

EVANS, E. C., of Penygraig, Rhondda.

No. 23,110; Aug. 5, 1920.

This invention has for its object to effect the distillation expeditiously by internally heating the charge—that is to say, by the employment of hot gases which are admitted into the retort to heat the charge and to carry out of the retort the gases and vapours as they are produced. The invention is said to be of special utility in the destructive distillation of coal at low and moderately low temperatures—for example, from 750° to 1500° Fahr., for the production of a residue containing a substantial proportion of volatile constituents.

According to the invention a gas producer is employed for commencing the distillation, and is admitted for the combustion of this gas in a chamber adjacent to the retort whence the gases pass through the retort. The retorts are advantageously of the vertical type. The hot heating gases are admitted near the lower end of the retort, and pass upwardly through the charge, and thence outwardly through the gas and vapour outlet pipe at the upper end of the retort. The gas and vapour pass into the tar main and to scrubbers and purifiers, as is usual in gas-works practice.

Means are provided [but no illustrations are given with the specification] for continuously charging the retorts at the top and for removing the residue at the bottom; and after the distillation of the charge has been effected and gas and vapour produced, the resulting gas, or part of it, is used for the purpose of combustion in the combustion chamber, and the gas-producer may then be put out of operation—the distillation in the retorts being effected entirely by the use of hot gases produced on the combustion of the permanent gas derived from the retort.

The means for continuously charging the retort may be those usually employed, and those for removing the residue may be such as are generally known. Again, the retorts may be of any suitable form; but, with a view to deriving the utmost advantage from the distillation by the use of hot gases internally applied, the patentee prefers to provide the retorts of relatively considerable section and of such a height in relation to the rate of feed of the coal and withdrawal of the residue that the charge may be carbonized to the extent required in its descent in the retort. Thus, a convenient retort for the purpose is one of circular section and about 40 ft. high and 13 ft. dia. The combustion chamber is advantageously provided with enclosed chequered brickwork with partition walls therein to give a tortuous course to the gases; and at the inlet to the combustion chamber means are provided for the admission of an adequate quantity of air which may be pre-heated in any suitable way—as, for example, by its admission through flues adjacent the combustion chamber, and the air supply derived from a fan may be regulated by valves or dampers. Means may be provided under the control of valves or dampers for the alternate admission of gas from a gas-producer and gas derived from the retorts, and means may be provided by which the respective retorts in a series or battery may be separately started in operation by the use of a single gas-producer provided with valves or dampers by means of which the gas therefrom may be directed to any one in the series or battery.

When so providing a series or battery of retorts, a combustion chamber may be provided to serve one retort or more in common, or one combustion chamber may be provided for all retorts; while, again, instead of producing heating gases, in a combustion chamber, the gas used for internally heating the charge in the retorts may be admitted direct to the retort, with an adequate supply of air, at a position near the bottom of the retorts. The amount of gas admitted to the combustion chamber or directly to the retort may be controlled by valves or dampers, as is also the air supply, so as thus to regulate the temperature of distillation.

Instead of providing the combustion chamber separate from the re-

tort, it may be incorporated in the same setting with the retort, in the lower part thereof, as an annular chamber.

The retorts may take any suitable shape. They may be of circular section, outwardly flared towards their lower ends, or they may be formed contracted slightly for a short distance above the position of admission of the heating gases in order to ensure the carbonization of the central portion of the charge.

According to the invention, means may be provided for the regulation of the temperature of the heating gases by one or more of the following methods: (1) By the admixture with the heating gas of unburnt producer gas or retort gases freed from their tarry constituents. (2) By the regulated admixture of steam therewith. (3) By the regulated admixture of air.

Coin-Freed Gas-Meters.—No. 171,164.

SMITH, E. W., and SMITH METERS, LTD., of Kennington Park Road, S.E.

No. 23,327; Aug. 9, 1920.

This invention embodies the coin mechanism described in patent No. 9961 of 1908, with the modification that a spur toothed crown wheel is rigidly attached to the back of the coin crown toothed wheel referred to with a portion between them which acts as a bearing for the two wheels and enables them to be revolved together. The spur crown wheel meshes with a long pinion capable of longitudinal movement, internally threaded and mounted on a screwed shaft set at right angles to the spur crown wheel. The shaft is rotatable in fixed bearings by a worm, from the ordinary index spindle. Attached to the long pinion is a grooved disc, which carries out substantially the same functions as the grooved disc described in the earlier patent.

With this construction, upon rotating the spur crown wheel, by means of the coin action, the long pinion is rotated and screwed lengthwise along the threaded shaft—thus operating the valve gear, and permitting a supply of gas to pass through the meter. The meter, in turn, revolves the shaft, and screws the long pinion back to its original position, thereby cutting-off the supply of gas. The spur crown wheel prevents the rotation of the long pinion, but allows it to slide through its teeth longitudinally. This mechanism is preferably mounted with the face to the coin wheel towards the front of the meter, so that the coin slot faces the operator.

Fig. 1.

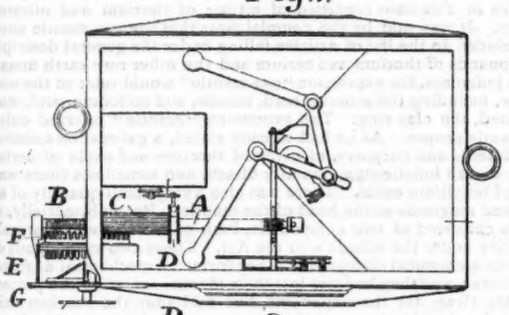


Fig. 2.

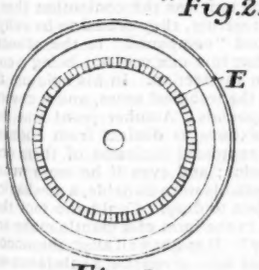


Fig. 3.

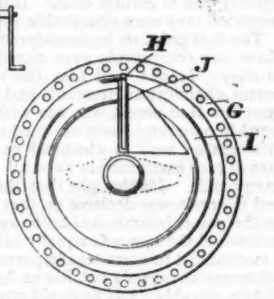


Fig. 4.

Smith's Coin-Freed Gas-Meter.

Fig. 1 shows the mechanism from the top in a meter the cover plate of which is removed. Fig. 2 shows the long pinion and its threaded shaft as seen from the front. Fig. 3 shows the coin spur wheel in elevation (on a larger scale). Fig. 4 shows the coin-carrier from inside—its operating handle being indicated by dotted lines.

The meter has the usual link mechanism, index, and valve lever. The spindle of the index carries a worm in mesh with the worm wheel on the shaft A, which is threaded at B. A long pinion C, having an internal screw fitting the thread B, is mounted over the shaft, and has a grooved disc D adapted to actuate the valve lever and to open and close the valve as usual. The coin wheel E is rigid with the spur crown wheel F—being in constant mesh with the pinion C.

An adjustable plate G, with a coin opening H, closes the front of the coin chamber and carries a rotatable disc I having a coin-carrier J. The disc is rotatable by an external handle so that an appropriate coin inserted through opening H into coin-carrier will engage the teeth of the coin wheel E and enable it to be turned by the handle a distance according to the position at which the cover plate, and consequently the coin slot, is set in relation to a stop (not shown) which limits the rotation of the coin-carrier.

Plugging Gas-Mains.—No. 171,166.

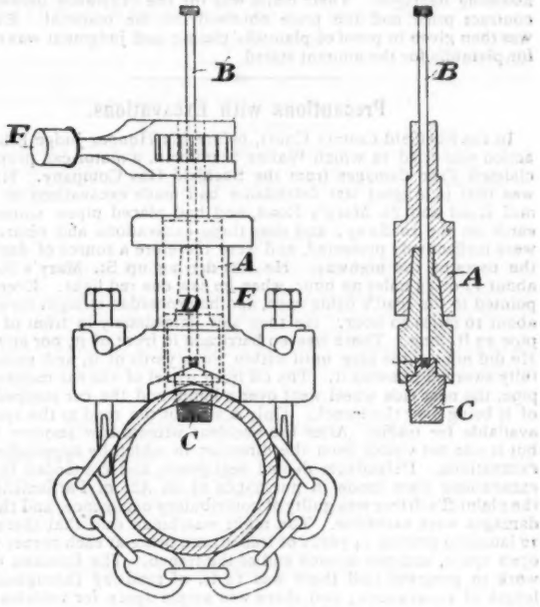
WINGFIELD, E. R. H., of Ealing, and JENNINGS, G. L., of Gunnersbury, W.

No. 23,348; Aug. 9, 1920.

This invention consists of means to be used with the apparatus generally employed during the drilling and tapping of a gas-main, "which will to a great extent prevent the loss of gas that occurs during the drilling, tapping, and plugging."

The means referred to consists of a supplementary chuck (termed an adaptor) which will enable the drill stand body and ratchet brace used in the drilling and tapping of a hole to be employed in the plugging of the main. The adaptor is constructed of a main part or body and of a rod which fits a hole running through the centre of the main part or body, which is made for a part of its length of a diameter corresponding to that of the chuck that fits the drill stand body, and is provided at its lower end with a recess for receiving the upper part of the plug to be screwed into the main. This plug is provided at its top with a square boss formed with a screwed recess. The rod which runs through the centre of the adaptor is provided at its lower end with screw threads corresponding to the screwed recess formed in the square boss of the plug.

The illustration shows the adaptor in use, and a section of the adaptor with a plug attached to it.



Wingfield's Gas-Main Driller.

A is the body or main part of the adaptor, and B is a rod which snugly fits a hole running through the centre of the body and serving as a means for temporarily supporting or holding the plug C, which has to be screwed into the tapped hole formed in the main. The main part A is made of a length corresponding to that of the chuck of the combined drill and tap and, for at least a considerable part of its length, of the same external diameter as the chuck. Thus it will, like the latter, fit the bore of the drill stand body E. This body is provided at its bottom with a recess for the upper part of the plug and with a square top adapted to receive the ratchet of the ratchet lever. The rod B is formed at its lower end with screw threads corresponding to those in a screwed recess in the top of the plug and at its upper end with a milled head by which it can be readily rotated and screwed into the plug.

The adaptor is used as follows: The gas-main having been drilled and the drilled hole tapped in the usual way, the chuck D, holding the combined drill and tap, is removed from the drill stand body and is immediately replaced by the adaptor A, B, having the plug C attached. The few turns of the ratchet necessary for screwing the plug into the tapped hole in the main are then given to the adaptor. After this the rod is unscrewed from the head of the plug and the adaptor removed, leaving the tapped hole properly plugged.

Price Reduction at Tottenham.—The Tottenham District Light, Heat, and Power Company have reduced the price of gas by 1d. per therm from the Christmas quarter. This will bring the charge per 1000 c.ft. down to 4s. 10½d. The Company supply a large area, including Tottenham, Edmonton, Wood Green, and Enfield.

Wages and Prices at Sidmouth.—The report which the Gas Committee submitted at the last meeting of the Sidmouth Urban District Council included a recommendation that the scale of decreases adopted by the Joint Industrial (Non-Trading) Council be made applicable to the gas employees. The Chairman (Mr. J. G. H. Halse) hoped their men would appreciate that the Council were dealing with them more generously than did the agreement with the Federation of Gas Employees. The Committee had asked the Gas Manager (Mr. H. Burgess) for details, which he expected would result in a recommendation at the next meeting to reduce prices, though he did not think they would be retrospective. At the same time, they hoped to be in a position to grant special terms for those who used gas for power or in large quantities.

LEGAL INTELLIGENCE.

A Coal-Tar Pitch Contract Dispute.

In the King's Bench Division of the High Court of Justice on Wednesday last, before Mr. Justice Greer, Messrs. Thomas Rose and Partners, Ltd., of Hull, obtained judgment for £10,635 15s. 5d. and costs against the Jaffree Transport, Shipping, and Trading Company, Ltd., of Cardiff, for their failure to take delivery of a quantity of coal-tar pitch. There was no defence. Mr. Duolop, K.C., for the plaintiffs, said the defendants (who did not appear), on Aug. 6, 1920, agreed to buy from the plaintiffs 2000 tons of pitch for export to France. They failed to take deliveries. The pitch was to be delivered in monthly instalments from September to December inclusive. During December, the parties, by mutual agreement, cancelled the first instalment on the terms that the plaintiffs should allow the defendants 1s. per ton; so that 500 tons went out of the case. The plaintiffs had given credit in their claim for the 1s. a ton they agreed to pay to the defendants on the first instalment. The defendants failed to take delivery of the remaining instalment, amounting to 1500 tons; and a writ was issued on June 19, 1921, claiming damages for failure to accept. Points of claim were delivered on Nov. 10, and on Nov. 25 his Lordship gave plaintiffs judgment in default of defence for damages to be assessed. Plaintiffs now came before the Court for the purpose of assessing damages. Their claim was for the difference between the contract price and the price obtained for the material. Evidence was then given in proof of plaintiffs' claim; and judgment was entered for plaintiffs for the amount stated.

Precautions with Excavations.

In the Sheffield County Court, before his Honour Judge Elliott, an action was tried in which Walter Staniforth, a motor-car proprietor, claimed £100 damages from the Sheffield Gas Company. His case was that in August last defendants had made excavations in Leadmill Road and St. Mary's Road, and had placed pipes, stones, and earth on the roadway; and that these excavations and obstructions were ineffectively protected, and were therefore a source of danger to the users of the highway. He was driving up St. Mary's Road at about 12 or 15 miles an hour, when he saw one red light. Everything pointed to the road's being open, and he proceeded straight forward at about 10 miles an hour. He then saw immediately in front of him a pipe 20 ft. long. There was no barricade in front of it, nor any light. He did not see the pipe until within three yards of it, and unsuccessfully swerved to avoid it. The off front wheel of the car mounted the pipe, the near side wheel went over a lamp, and the car stopped, part of it being over the trench. Only a strip of the road at the spot was available for traffic. After the accident witness saw another lamp; but it was not visible from the direction in which he approached the excavations. Defendants denied negligence, and contended that the excavations were made in pursuance of an Act of Parliament, that the plaintiff's driver was guilty of contributory negligence, and that the damages were excessive. The night watchman said that there were 12 lamps to protect 44 yards of trench, one being at each corner of the open space, and one at each end of the trench. The foreman of the work in progress said there was 19 ft. of roadway throughout the length of excavations; and there was ample space for vehicles to be driven in safety. Mr. Siddons, a supervisor of excavations employed by the Gas Company, said the lighting of the trench was ample for safety. In his fifteen years' experience, there had been no accident of the same kind due to deficient protection of trenches by light. The red light at the end should have warned an approaching driver to go steady. His Honour said the defendants were not called upon to insure people against accidents, but only to give such warning as would be sufficient protection to reasonable persons against injury. In his opinion this was done; and he therefore found that the defendants were not guilty of negligence.

New Purifiers and Station Meter at Belfast.

Last Friday morning, the Belfast Corporation Gas Committee met at the gas-works, Ormeau Road, for the purpose of inspecting and starting to work new purifiers erected by Messrs. R. & J. Dempster, Ltd, of Manchester, and also a station meter supplied by Messrs. Parkinson and W. & B. Cowan, Ltd., of London. The gas was turned on to the new plant by the Chairman of the undertaking, in the presence of the Committee and representatives of the contractors—the latter being Mr. Perkins and Mr. Scott, of Messrs. R. & J. Dempster, and Mr. William Parkinson, of Messrs. Parkinson and Cowan. The new gasholder tank in process of construction was also inspected, as well as other plant on the works. The contract was for six luteless purifiers, complete with oxide floors and oxide-handling plant, roofs and structure, in accordance with the specification and plans of Mr. James D. Smith, Engineer and Manager of the Gas-Works. Messrs. Dempster carried out the work in a very satisfactory manner; and the Committee were greatly pleased with the plant. The station meter (to pass 300,000 c.ft. of gas per hour) was also approved of by the Committee. The Chairman of the Committee (Councillor Frank Workman, D.L.) afterwards entertained the party at luncheon in the gas-works offices.

French Gas Engineers Visit England.—A party of gas engineers from various centres in France, who are conducting an investigation into British methods, paid a visit to Blackburn last Friday. They were accompanied by a representative of contractors responsible for the extensions at the Greenbank works, and were received by Mr. G. P. Mitchell, the Corporation Gas Engineer. The works at Addison Street and at Greenbank were inspected; the whole day being spent in the town. The deputation were particularly impressed with the machinery now being installed at the latter works.

MISCELLANEOUS NEWS.

TAXING FOREIGN GAS-MANTLES.

Application under the Safeguarding of Industries Act.

THE REFEREE'S JUDGMENT.—DEC. 10.

Mr. Cyril Atkinson, K.C., the Referee appointed by the Lord Chancellor to consider applications with regard to goods included in or excluded from the list published by the Board of Trade under the Safeguarding of Industries Act, gave judgment in regard to the gas-mantle case, as reported in the "JOURNAL" last week, pp. 695-7.

The REFEREE said that the complaint was that gas-mantles had not been included by the Board of Trade in the list published by them containing articles covered by the words in the schedule to the Act "compounds (not including ores or minerals) of thorium, cerium, and the other rare earth metals." The complaint was made by the Incandescent Gas-Mantle Manufacturers' Association and by the manufacturers of thorium salts, and was opposed by the Board of Trade and the National Gas Council—an association of gas undertakings owned by companies and local authorities responsible for 95 p.ct. of the gas produced and sold in this country. Incandescent gas-mantles were now made as follows: They were first woven into cotton or other fabric, and closed in at the head with a piece of asbestos cord, which was attached to the head for the purpose of suspending the mantle. The mantle was then dipped into a solution of 99 p.ct. of nitrate of thorium and 1 p.ct. of nitrate of cerium. The head of the mantle was next strengthened by being dipped in a solution of alumina and magnesia. The mantle was then fired, and the cotton or other fabric entirely disappeared save for the very slightest trace of ash; and the nitrates of thorium and cerium were converted into oxides of thorium and cerium. The mantle was then a structure consisting to all intents and purposes entirely of these oxides. For the purpose of storage and carriage, it was strengthened by being dipped into collodion, which behaved as a skin to the outside of the mantle. In general, the mantle was imported into this country in this form; and it consisted of an asbestos thread or cord supporting the mantle composed of oxides of thorium and cerium with the skin of collodion. In the case of the inverted mantle, it was suspended by a clay ring. Sometimes mantles were imported before the cotton fabric was burned-off. They then presented the appearance of a soft fabric with the asbestos cord; and the mantles in this case consisted of nitrate of thorium and nitrate of cerium. It was said by the complainants that the gas-mantle should be included in the list of articles falling under the general description "compounds of thorium and cerium and the other rare earth metals." In his judgment, the expression "gas-mantle" would refer to the whole mantle, including the asbestos cord, mantle, and collodion, and, where it existed, the clay ring. The expression "mantle" referred only to the mantle proper. As he had already stated, a gas-mantle consisted, to all intents and purposes, of oxide of thorium and oxide of cerium. There was an infinitesimal quantity of ash, and sometimes there was a trace of beryllium oxide. There was also a very small quantity of alumina and magnesia at the head of the mantle. But, substantially, the mantle consisted of two compounds, both of which were chargeable with duty under the schedule to the Act. These two compounds did not form a chemical compound. They formed a mechanical aggregate or mixture; and they had not lost their identity. During the proceedings, Mr. Gray, for the opponents, had said that the thorium oxide had not lost its identity; and if this was true of thorium oxide, it was equally true of cerium oxide. If these two compounds were separately imported they were chargeable with duty.

The first point to be considered by him was the contention that as these two compounds were mixed together, they ceased to be subject to duty. It was said that the word "compound" in the schedule meant chemical compounds, and that this mixture, not being a compound in that sense, was not within the section. In his opinion, the word "compound" was not used in the technical sense, and it covered mixtures as well as chemical compounds. Another point was that ores of rare earth metals were all mixtures as distinct from chemical compounds. He thought that the expressed exclusion of these ores and minerals was decisive on that point; and even if he were wrong on the point, inasmuch as both ingredients were dutiable, a mechanical mixture of the two was equally subject to duty. Could the fact that a mechanical mixture was imported in the form of a mantle make any difference as regards liability to duty? It might well affect the amount of duty payable; but he could not see how, given that a substance was dutiable, it could cease so to be by reason of the form in which it was imported. He was therefore of opinion that a mechanical compound of oxides of thorium and cerium in the form of a gas-mantle, whether before or after the cotton or silk fabric was burned-off, was subject to duty within the Act. But he was asked to go further and say that the gas-mantle, as it was a compound, was within the meaning of the words in the schedule to the Act. The gas-mantle as a whole was clearly within section 1, sub-section 4. It was a compound article of which two substances liable to duty, and which had not lost their identity, formed part. He could not accept Mr. Terrell's contention, for the complainants, that the word "compound" in the schedule had the same meaning as a "compound article" within section 1, sub-section 4. Great stress was rightly laid by Mr. Gray, for the National Gas Council, on the presence in the schedule, after the words "metallic tungsten" "and manufactured products of metallic tungsten," and the absence of corresponding words with reference to compounds of the rare earth metals. Apart from this, he should have thought the word "compounds" referred rather to substances than specific articles. The absence of reference to products was sufficiently significant to rule-out an interpretation of the word "compounds" wide enough to include manufactured compound articles of which a compound of rare earth metals formed merely a part. In his opinion, the result was that while it was impossible to include gas-mantles in the list of goods liable to duty, it was quite clear that the most material part of the gas-mantle consisted entirely of substances which were liable to duty. He

could foresee a question of some difficulty arising under section 10: "The value of any imported goods for the purpose of this Act shall be taken to be the price which an importer would give for the goods if the goods were delivered to him, freight and insurance paid, in bond at the port of importation, and duty shall be paid on that value as fixed by the Commissioners." Was the price which the importer would give to be the price he would give for the oxides of thorium and cerium in the form in which they were imported—*i.e.*, the price he would give for the mantle—or was it merely the price he would give for the oxides *qua* oxides? There might be much to be said in favour of valuing the dutiable substances, according to the form in which they were imported; but this question was not for him to decide—it arose under section 10. It was then contended by Mr. Gray that, even if the oxides or nitrates in question were chargeable with duty, there was no obligation to mention gas mantles or mantles in the list; and if mantles were chargeable in respect of any substances in their composition, these substances were covered by the words "oxide of thorium" and "oxide of cerium" or "nitrate of thorium" and "nitrate of cerium" already in the list, and that there was no necessity to go further and specially mention mantles. He himself did not take this view. The view and attitude of the Board of Trade had been that the general words in the list did not cover mechanical compounds or mixtures of substances mentioned, whether they were in the form of mantles or anything else, or in any form at all. There was no intention of charging duty upon mantles or any part of, or ingredients in, mantles by virtue of any words that at present appeared in the list. This was a document issued by the Board of Trade, and must be interpreted according to the meaning put upon it by the Board of Trade. If the Board said, as they did say, that there were no words in the list covering the mechanical compounds mentioned; and if he (the Referee) thought that there ought to be words there which covered such compounds, it seemed to him the list should be amended so far as it was necessary to give effect to his decision. He thought that subsection 5 of section 1 of the Act meant that if lists were issued, they were to define the specific articles to be taken as falling in the general description in the schedule. If they examined the list already published, it would be seen that the Board of Trade had taken the same view. Under the heading "Optical Glass," the Board of Trade had not been content merely to include lenses generically, but they had mentioned specifically twelve different lenses. Again, under "Optical Instruments" one did not find generic expressions, but different instruments were specifically mentioned. Eight different levels were mentioned; and he thought this was right. The object of the list was to prevent disputes with the Customs officers. He had no doubt that many importers could not be expected to know whether the different articles passing through their hands came within such expressions as "oxide of thorium" and "oxide of cerium;" and the purpose of the list was to inform all persons interested exactly what articles were subject to duty. He thought words must be added to the list to make it clear that mechanical compounds of oxides or nitrates of thorium and cerium in the form of mantles are subject to duty. How the duty was to be collected it was not for him to say. He therefore directed that there be added to the appropriate list the words "mechanical compounds of nitrates of thorium and cerium and of oxides of thorium and cerium in the form of mantles, or forming part of mantles, used in incandescent lighting." He wished to add that he did not think he was entitled to take into consideration statements made in Parliament as to the meaning of words used in the Act, or as to the intention of the Legislature.

Mr. J. HUNTER GRAY, K.C. (for the National Gas Council), said that what the complainants had asked for up to now was that gas-mantles, as such, should be specified in the list. For the moment he was not there to argue anything else; but the complainants had not succeeded in that. Had they succeeded, it would have meant that the duty would have been chargeable on the price of the gas-mantle. In these circumstances, he submitted that the complainants had not succeeded; and he therefore asked for his clients' costs.

The REFEREE said he had been thinking a good deal about this matter, not merely in connection with this particular case but in reference to all these cases. His view was that these were not cases in which costs ought to be given on either side unless there were some special circumstances. There was no duty on the Board of Trade to issue lists; but the issue of a list, even if there were a few mistakes in it, or a few matters on which different people took different views, must prevent countless disputes and a tremendous lot of uncertainty. They had only to look at the list to see the immense care that had been taken in getting it up; and the mere fact that there might be difference of views regarding certain matters in it did not seem to him to justify the awarding of costs. This applied both ways. At the same time, if he came to the conclusion that the complainants had come without any justification at all, the position would be different; but he was not prepared to award costs unless there were special circumstances.

Mr. J. HUNTER GRAY said, if he might say so with respect, that this was his own view on the matter.

Mr. TERRELL, K.C., for the complainants, said he was going to ask for costs if he thought the Referee had proper discretion to give them; but that was why he did not say anything about the matter. The opponents in these cases, other than the Board of Trade, were not really persons who were entitled to be heard under the Act; but it was thought fairer that anyone interested should be heard, and to that extent he had not opposed his friend's clients appearing. Perhaps he would not have been successful if he had; but he submitted that this was not a case in which the Referee had the jurisdiction to award costs under the Arbitration Act or any Act. It was not exactly an arbitration, and in any event it was only an arbitration between the complainants and the Board of Trade.

The REFEREE said he thought there was great difficulty, if it was put in that way; but at any rate in this case he would not award costs on either side.

Subsequently, discussion took place as to the advisability of applying for a case to be stated.

Mr. TERRELL asked the Referee to read the words which he proposed to add to the list.

The REFEREE read as follows: "Mechanical compounds of nitrate of thorium and cerium and oxides of thorium and cerium in the form of mantles or forming part of mantles used in incandescent gas lighting."

Mr. TERRELL: Then I do not think we shall ask you to state a case.

This closed the proceedings.

GAS REGULATION ACT APPLICATIONS.

The following further notices have appeared in the "London Gazette" of applications by gas undertakings to the Board of Trade under section 1 of the Gas Regulation Act.

Bath Gas Light and Coke Company.

The maximum prices now authorized in respect of the supply of gas by the undertakers are (i) the price of 3s. 9d. per 1000 c.ft. within the city of Bath and the parishes of Weston, Swainswick, and Charlcombe; and (ii) the price of 5s. 6d. per 1000 c.ft. in any other part of the limits of supply of the undertakers. The prices which they have asked the Board of Trade to substitute for these are 13·65d. per therm for the price of 3s. 9d. per 1000 c ft., and 17·85d. per therm for the price of 5s. 6d. per 1000 c.ft.

Ferndale Gas Company, Ltd.

The standard price now authorized in respect of the supply of gas by the undertakers is 5s. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 25·8d. per therm.

Rochdale Corporation.

The maximum price now authorized in respect of the supply of gas by the undertakers is 5s. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1s. 4d. per therm.

Rugeley Gas Company.

The standard price now authorized in respect of the supply of gas by the undertakers is 4s. 3d. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1s. 10d. per therm.

SPECIAL ORDERS.

Farnham Gas and Electricity Company.

Notice is given by the Company of an application under section 10 of the Act for a Special Order to authorize them to supply gas within the parish of Dockenfield and part of the parish of Binsted; to use for gas-works purposes certain land scheduled; to raise further capital; and to make further provision as to the supply of gas and the prices to be charged.

DECLARATIONS OF CALORIFIC POWER.

Chertsey Gas Consumers' Company, Ltd.—480 B.Th.U. (Dec. 30.)
Chesham and District Gas Company.—480 B.Th.U. (Dec. 12.)
St. Neots Gas and Coke Company.—475 B.Th.U. (Jan. 1.)
Exeter Gas Light and Coke Company.—475 B.Th.U. (Dec. 19.)

GAS REGULATION ACT ORDERS.

The Director of Gas Administration has forwarded copies of the following further Orders made by the Board of Trade under section 1 of the Gas Regulation Act.

Broadstairs Gas Company.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 19·2d. per therm.

For the purpose of ascertaining the authorized rate of dividend for the year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by four-and-one-half. (Dec. 5.)

Canterbury Gas and Water Company.

After the declared date, the standard prices in respect of gas supplied by the undertakers shall be 15·4d. and 17d. per therm; and these prices respectively shall be substituted for the prices of 3s. 4d. and 4s. per 1000 c.ft. mentioned in section 44 (fixing standard price of gas with sliding-scale as to dividend) of the Canterbury Gas and Water Act, 1890.

For the purpose of ascertaining the authorized rate of dividend for the year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by four-and-seven-tenths. (Dec. 7.)

Chesham and District Gas Company.

After the declared date: (1) The standard price in respect of gas supplied by the undertakers shall be 17d. per therm; (2) "2·4d. per therm" shall be substituted for "1s. per 1000 c.ft." in section 55 (dividend dependent on price charged) of the Chesham and District Gas Act, 1911.

For the purpose of ascertaining the authorized rate of dividend for the year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by four-and-four-fifths.

Prepayment meter clauses are included. (Dec. 3.)

Dursley Gas Light and Coke Company, Ltd.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 17d. per therm.

For the purpose of ascertaining the authorized rate of dividend for the year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the year (if any) before the declared date

shall be rendered into the equivalent price per therm by dividing it by four-and-three-quarters. (Dec. 8.)

Exeter Gas Light and Coke Company.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 16·8d. per therm.

For the purpose of ascertaining the authorized rate of dividend for the year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by four-and-four-fifths.

After the declared date, "12·6d. per therm" shall be substituted for "3s. for every 1000 c.ft. thereof" in section 58 (regulating supply of gas, and price for public lamps) of the Exeter Gas Act, 1865. (Dec. 8.)

Folkestone Gas and Coke Company.

After the declared date: (1) The standard price in respect of gas supplied by the undertakers shall be 15·8d. per therm; (2) the price of 16·8d. per therm shall be substituted for the price of 3s. 9d. per 1000 c.ft. whenever it occurs in subsection 1A of section 41 (price of gas sliding-scale) of the Folkestone Gas Act, 1916.

For the purpose of ascertaining the authorized rate of dividend for the half year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the half year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by five.

After the declared date, "1d. per therm" shall be substituted for the "6d. per 1000 c.ft." in subsections (2) and (3) of section 41 of the Folkestone Gas Act, 1916.

After the declared date, the prices of 15·8d. per therm and 16·8d. per therm respectively shall be substituted for the prices of 3s. 4d. and 3s. 9d. per 1000 c.ft. wherever they occur in section 42 of the Folkestone Gas Act, 1916.

Prepayment meter clauses are included. (Dec. 3)

Kidsgrove Gas Light Company.

After the declared date: (1) The standard prices in respect of gas supplied by the undertakers shall be 14d. and 14·6d. per therm; and these prices respectively shall be substituted for the prices of 3s. 3d. and 3s. 6d. per 1000 c.ft. mentioned in subsection (1) of section 19 (dividend dependent on price charged) of the Kidsgrove Gas Act, 1914; (2) "0·6d." shall be substituted for "3d." in the first proviso to subsection (1) of section 19 of the Kidsgrove Gas Act, 1914.

For the purpose of ascertaining the authorized rate of dividend for the year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by four-and-seven-tenths.

After the declared date, the word "therm" shall be substituted for the expression "1000 c.ft" in section 60 (Company to supply public lamps) of the Kidsgrove Gas Light Act, 1871.

Prepayment meter clauses are included. (Dec. 6.)

Leyland Gas Company.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 16 6d. per therm.

For the purpose of ascertaining the authorized rate of dividend for the year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by four-and-two-thirds.

Prepayment meter clauses are included. (Dec. 7.)

Stamford and St. Martin's (Stamford Baron) Gas Light and Coke Company.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 15·8d. per therm.

For the purpose of ascertainng the authorized rate of dividend for the year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by four-and-three-fifths. (Dec. 7.)

SOUTH SHIELDS GAS ORDER.

The Town Clerk of South Shields reports that the Board of Trade have now made an Order under the Gas Regulation Act with reference to the application of the South Shields Gas Company, and have fixed the new standard price in respect to the gas to be supplied by the Company. The Order is dated Nov. 7, and came into operation on that date. The standard price is to be 14·4d. per therm.

The standard price according to the provisions of the existing Act is 3s. per 1000 c.ft.: and the new price at 500 B.Th.U. per 1000 c.ft. is equivalent to 6s. per 1000 c.ft. The application by the Company to the Board was to fix the price at 7s. 2d. per 1000 c.ft. at 500 B.Th.U., or 17·2d. per therm.

The charge for the hire of prepayment meters and fittings has been increased by the Order 50 p.cent. on existing charges.

Dublin Gas-Workers' Disputes.—Two disputes occurred last week between the Alliance and Dublin Consumers' Gas Company and sections of their employees. In the first, carters struck work over a question of dispensing with their boy assistants; and in the second, objection had been taken to the employment of ex-members of the Irish Transport Union who had joined the Irish Engineering Union without paying their subscriptions to the former body. In both matters an early adjustment was made, and work was resumed. A conference between representatives of the Company and of the employees on the question of reduced wages agreed to the continuance of the cut of 3s. weekly; consideration of the second cut of 3s. being deferred until January.

POTTERIES GAS-WORKS ACQUISITION.

At a Special Meeting on Thursday last, the Stoke-on-Trent Town Council decided to promote a Bill in the ensuing session of Parliament empowering the Corporation to acquire the Potteries undertaking of the British Gas Light Company, Ltd., and to amalgamate the undertaking with the existing municipal gas-works in the county borough. The purchase price agreed upon by representatives of the Corporation and the Company was £345,000—£100,000 to be paid in cash, and the remainder in Corporation bonds. It was also agreed that the Corporation should take over the liability for £40,000 of 3½ p.cent. debentures, thus bringing-up the figure to £385,000. In a report to the Council some time ago, the Gas Engineer (Mr. A. Mackay) gave £15,000 as the outside estimated figure for transfer costs and compensation to officials. On this basis, the total cost of purchase worked out at £400,000.

The MAYOR (Mr. S. Sproston) proposed the resolution for the promotion of the Bill, remarking that the Council had already adopted the recommendation of the Gas Committee in favour of the purchase of the British Gas Light Company's undertaking.

Alderman A. BROOKHOUSE (Chairman of the Gas Committee), who seconded, said that, though the Council had sanctioned the compulsory purchase of the undertaking, the Committee had achieved their desire to reach an agreement with the Company on the question of price. He was confident that, as a business proposition, the purchase of the undertaking was sound in every respect.

Mr. F. T. H. GOODWIN reminded the Council that, at the time the negotiations were carried out, money was very difficult to obtain; and anything from 6 to 7 p.ct. was the prevailing rate. He inquired what provision was made in the Bill to enable the Council to get the benefit of whatever easier rates might rule in future.

The TOWN CLERK (Mr. E. B. Sharpley) informed the Council that the period for which the Company will be entitled to 5 p.ct. would be fifteen years. After that time, at the option of the Corporation, not at the option of the Company, the amount might be paid off or reduced. If at the end of fifteen years they found that they were in a position to secure money at less than 6 p.ct., they could pay off the amount of stock issued to the Company, and borrow elsewhere.

Mr. GOODWIN thought that fifteen years was a very long term for the payment of 6 p.ct., and asked if the Corporation were irrevocably bound to this period.

The TOWN CLERK said the Council had agreed with the Company that part of the purchase money should be the issue to them of certain stock bearing interest for fifteen years at 6 p.ct.

The resolution for the promoting of the Bill was carried without a dissentient.

LANARK GAS-WORKS EXTENSION.

The formal opening of the extensions at the Lanark Gas-Works took place in the presence of a large gathering of the Town Council and other leading business men. The new plant includes an installation of six vertical retorts with a consumption of 21 tons of coal per day, and a gas production capacity of 350,000 c.ft. per twenty-four hours. The Woodall-Duckham Company were the contractors; and the cost has been £18,300. All up-to-date appliances have been introduced. At the opening ceremony, Provost Graham presided.

Councillor Muir, the Convener of the Gas Committee, said that the problem before them last year was whether they should increase the number of the old retorts, or go on with a new scheme. By the new installation, they would get an increased quantity of gas, and a superior quality of gas, much more economically produced. He spoke in high terms of the expeditious and efficient manner in which the Woodall-Duckham Company had carried out their contract.

At a meeting in the Council Chambers (in a social capacity) Bailie MacAuslan proposed the toast of the contractors, and Mr. Beale replied.

The first Gas Company was formed in Lanark in 1830; new works and new plant were erected in 1860; and in 1913 the Town Council purchased the gas-works at an expenditure of £17,000.

BURNLEY GAS-WORKS ACCOUNTS.

Mr. J. P. Leather, the Gas Engineer to the Burnley Corporation, has issued his annual report; and in it he states that, for the twelve months under review, the make of gas was 820,885,000 c.ft., an increase of 12·48 p.ct. on the previous year, when the increase was 15·36 p.ct. The greatest amount sent out in one week was 23,157,000 c.ft.; and the largest day's consumption was 3,725,000 c.ft., on Dec. 20. The gas sold was 725,622,437 c.ft.; and after deducting the gas consumed in the works and by public lamps, there was 40,714,153 c.ft., or 4·96 p.ct. of the make, unaccounted for. Of the make of gas, 6·3 p.ct. was used for motive power, 2·9 p.ct. for cooking and heating by separate meters, 49·9 p.ct. for other purposes through ordinary meters, and 40·9 p.ct. by prepayment meters.

Though the quality of the coal continued much inferior to pre-war material, the department produced 13,049 c.ft. of gas per ton, which was a considerable increase on previous results. There was 22,370,000 c.ft. more of coal gas made with 8423 tons of coal less, as compared with 1914. Water gas made was 22·9 p.ct. of the total. The cost of gas-making materials was £113,738, or 35·81d. per 1000 c.ft. of gas sold. Wages again showed a considerable increase; being 22·09d. per 1000 c.ft., as against 18·62d. the previous year.

It will be necessary for some time to come, Mr. Leather states, to spend considerable sums in work which had been deferred on account of the war. The department had not even yet been able to bring the plant up to the pre-war state of repair. The cost of works maintenance worked-out at 9·21d. per 1000 c.ft.

The quantity of sulphate of ammonia produced during the year was 430 tons which, allowing for the stocks of liquor at the beginning and

end of the year, was equal to 18·85 lbs. per ton of coal, as compared with 22·2 lbs. last year. The net receipts per ton of sulphate produced averaged only £7 3s. 5d., after paying for acid, wages, and carriage. The slump in the export market since November last year made the present value little more than the cost of manufacture.

The quantity of tar produced was 2441 tons, of which 45 tons were sold, and 2487 tons distilled. The following products were obtained:

Crude naphtha	6,676 gallons.
Light oil	36,352 ,,
Light creosote	16,829 ,,
Heavy creosote	120,457 ,,
Creosote salts	41 tons, 13 cwt., 3 qrs.
Pitch	1,620 tons, 11 cwt., 1 qr.

The financial results were:

Sale of tar and products		£20,565 6 6
Stock, March 31, 1921		4,620 6 1
		£25,185 12 7
Less stock, March 31, 1920		2,847 19 8
		£22,337 12 11
Cost of distillation, wages, and materials	£979 3 9	
Fuel (5,610,000 c.ft. of gas)	841 10 0	
		1,820 13 9
Leaving		£20,516 19 2

This figure was equal to £8 8s. 1d. per ton of tar produced, as compared with £2 17s. 6d. per ton in the previous year. The value of tar products reached a high figure during the year, but came down rapidly later.

CEARÁ GAS COMPANY.

Another Difficult Year.

The Annual General Meeting of the Company was held on Thursday last, at the London Offices, No. 9, Queen Street Place, E.C.—Mr. F. W. BROTHERS (the Chairman) presiding.

The SECRETARY (Mr. E. Pratt) read the notice convening the meeting; and the report and accounts were taken as read.

The CHAIRMAN, in moving their adoption, went at considerable length into the difficulties of post-war conditions, which, he said, had during the past year showed no abatement. The accounts presented were for the twelve months ended June 30; and during this period coal difficulties were again experienced. The price in December, though far from the highest, was then about 90s. per ton. This coal arrived at Ceará in January, when a most extraordinary change in the method of imposing the customs duties was revealed. The duty on coal used to be from 5s. 4d. to 6s. per ton, on the fixed value of coal at 26s. 8d. per ton. This was revised by the Federal Government at Rio de Janeiro on Jan. 1, 1919; when a new duty was levied. This new tariff had been misinterpreted at all the custom houses along the coast, and the old rate charged. The new basis of duty, therefore, only came to notice at Ceará about the middle of October, 1920, when a demand was received for the extra duty on coal entries in 1919 and 1920, amounting to some £533, payment of which, pending inquiry, their Engineer succeeded in postponing for a time. On Jan. 23 last, when coal shipped in December arrived at Ceará, the duty came to 42s. 3d. per ton, which, with increased duty on articles required for renewals and repairs, left a commitment of more than the money then in hand. It being evident that the increased duties might prove an overburden to companies carrying out services of public utility, working under contracts with fixed prices, the Engineer proceeded to Rio de Janeiro to consult the British Embassy's Commercial Attaché. From him it was ascertained that an alleviation of the customs charge on coal was likely to be made by the Federal Government, by which it was expected that duty in the future might amount to 13s. 4d. per ton, according to the rate of exchange of the day. But a permanent increase of 8s. per ton appeared inevitable; and this would be about double the former duty. Representation was made by the principal coal exporting companies at the time; but little assistance could be given by the Foreign Office on matters affecting the fiscal policy of Brazil. The back-claim on coal arrivals in 1919-20 was subsequently settled; the duty thereon of £533 having been restituted. While at Rio de Janeiro, the Engineer brought to the notice of the British Embassy the history of the arrears of payment for the street lighting due from the State of Ceará, which amounted at June 30 to £14,847. The revenue of the State of Ceará not having been equal to the expenditure for some time past, an effort was being made to obtain a loan from American financial interests; and if it should prove successful, a recommendation by the British Embassy that this Company be paid a fair share of the arrears would be of service, and they would make every effort to obtain it. But difficulty arose from the fact that, apart from debts due to other creditors, the remuneration of the State officials themselves was known to be long overdue. He then went on to review the financial condition of the State of Ceará, from which, he said, it might be gathered that the recovery in its fortunes might be a matter of some years. The fall in exchange was a serious matter. The loss by depreciation of the currency from July to February last amounted to about £1500, which more than absorbed the £1050 required to pay the debenture interest for the six months then due. The loss on a remittance of £1000 at 8d. per milreis would be about £500; and for some few months remittances might not be possible, as it would not be in the interests of the debenture holders to remit at present, unless the lighting accounts should be near to the rate of exchange at which the accounts were payable. The Engineer also pointed out that during the war and since, gas as an illuminant had gone largely out of use. In January last, the Federal Government commenced a port works for Ceará which, if completed, should be helpful and stimulate trade. Should the State become unable to pay for the street lighting indefinitely, the lighting itself could not continue indefinitely. In comparing with past years, they had to look back to 1915, 1916, and 1917, which entailed loss and self-denial to keep things going. In those three years, the holding-over of the Directors' fees and the Secretary's salary just enabled the payment of the debenture interest at the due dates. Though the same procedure occurred at Dec. 31, 1919, he regretted even this sacrifice failed to keep the debenture interest going since June, 1920.

Mr. THOMAS M'MAKING seconded the resolution.

Mr. F. W. CHURCH said the shareholders could only sympathize with the Board in the position in which they were placed, and hope that matters would soon mend, so that shareholders might get some return on the money that they had invested.

The resolution was then carried; and afterwards the retiring Directors (Messrs. F. W. Brothers and T. M'Making) and the Auditor (Mr. W. J. Wright) were re-appointed.

The CHAIRMAN proposed a vote of thanks to the Engineer (Mr. W. A. Valon Watson) and staff in Ceará and the Secretary in London. He said Mr. Watson had had many difficulties to contend with, and had proved himself a good engineer and a man of resource.

Mr. CHARLES WEBB seconded the vote, which was passed, as was also a similar one to the Chairman and Directors, on the proposition of Mr. E. H. FISHER, seconded by Mr. CHURCH.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Dec.* 12.

In the London tar products market there is considerably more inquiry for pitch, and a fair amount of business is reported as being done. Makers' price to-day is firm at 60s. per ton net f.o.b. works. Creosote is steady at about 7d. per gallon net in bulk. In other products there is little change to report. Pure benzole and pure toluole are steady at about 3s. 4½d. to 3s. 6d. per gallon; while 95/160 solvent naphtha is about 3s. 3d. per gallon.

Pyridine bases is a little firmer at from 5s. 9d. to 6s. per gallon.

Tar Products in the Provinces.

Dec. 12.

The average values for gas-works products during last week were: Gas-works coal tar, 43s. 6d. to 47s. 6d. Pitch, East Coast, 47s. 6d. to 50s.; West Coast—Manchester, 40s. to 45s.; Liverpool, 40s. to 45s.; Clyde, 40s. to 45s. Benzole 90 p.ct. North, 2s. 4d. to 2s. 6d.; crude 65 p.ct. at 120° C., 1s. 11d. to 2s. naked at makers' works; 50-90 p.ct., naked, North, 2s. 3d. to 2s. 4d. Toluole, naked, North, 3s. to 3s. 1½d. nominal. Coal tar crude naphtha in bulk, North, 11d. to 11½d. Solvent naphtha, naked, North, 2s. 8d. to 2s. 9d. Heavy naphtha, North, 2s. 7d. to 2s. 9d. Creosote, in bulk, North, liquid, 6d. to 6½d.; salty, 5½d. to 6¼d. Heavy oils, in bulk, North, 9d. to 9¼d. Carbolic acid, 60 p.ct., 1s. 6d. Naphthalene, £15 to £20; salts, £7 to £9, bags included. Anthracene, "A" quality, 8d. to 10d. per minimum 40 p.ct.; "B" quality, nominal.

Manchester District Tar Prices.

The prices realized for tar in the Manchester district during the months of September and October were as follows: For September, £3 0s. 0·36d. per ton; for October, £2 14s. 7·46d. per ton.

FROM A MARKET CORRESPONDENT.

Bye-Products Trade.

The market seems rather better, with a larger volume of business passing since my last report. Prices, however, still continue on the dull side. The excitement in pitch appears to have died down for the time being, and the market seems a little stronger than it was. There is not much buying, however, at the moment, although there seems to be a better feeling on the export side of the trade. The latest values are from 40s. to 47s. 6d. per ton. There is no sign of any revival in the market for carbolic acid. Nominal prices remain at 1s. 6d. per gallon for crude, with crystals at 5d. per lb. There does not seem any likelihood of improvement here until the market in crystals improves, as manufacturers of this grade cannot pay more than 1s. 6d. per gallon for their crude material. At the same time, it is worth noting that distillers maintain that they cannot produce at 1s. 6d. Creosote is an easier market, with prices irregular at from 6d. to 7d. per gallon. Cresylic acid is quiet but steady at 2s. 4d. per gallon. Solvent naphtha is in fair demand at 2s. 10d. Benzole is also in fair request, and is merely kept from improving in value by the price of petrol. In intermediate products business remains quiet, although a fair inquiry is being received, particularly from abroad, and the general tone is better than of late. Beta naphthol is steady. Aniline oil and salts remain firm at 1s. 7d. and 1s. 9d. respectively. Salicylic acid, technical grade, is 1s. 4d. per lb.; but resorcin is rather cheaper at 6s. per lb. for technical grade.

Sulphate of Ammonia.

The position in sulphate of ammonia is without change, and prices are maintained at £15 13s. for neutral quality and £14 10s. for ordinary quality. Export business is still on a good scale in the neighbourhood of £16 10s. per ton. The German Nitrogen Syndicate announce that they anticipate resuming operations at the Oppau works early in the New Year, and they are, therefore, quoting prices for sulphate of ammonia from this source delivered in the spring. The latest official prices for sulphate in Germany as from the 5th of this month have been fixed at 25.80 Mks. for ordinary technical quality; while acid free and dry quality has been increased from 18 Mks. to 26·40 Mks.

The Bingley Urban District Council, who recently applied to the Board of Trade for power to increase the maximum charge for gas from the existing figure of 4s. 6d. per 1000 c.ft. to 6s. in the Council's district, and from 5s. 6d. to 7s. beyond that area, have received sanction to an increase of 1s. per 1000 c.ft. in each case.

Power-Gas Corporation.—For the year ended Sept. 30, the Corporation, after providing for liabilities to the Government, made a profit of £21,721, to which is added the balance of £11,850 brought forward, making £33,571. The sum of £4000 is placed to reserve, and a dividend at the rate of 6 p.ct. per annum, less tax, is proposed, leaving to be carried forward £11,594. In 1919-20 profits were £43,477; and the dividend was at the rate of 8 p.ct. per annum.

Public Lighting of Houghton-le-Spring.—The Houghton-le Spring (Durham) Urban Council adopted a defiant attitude towards the local Gas Company, when the latter suggested an increased scale of charges for public lighting in the Council's area. The Company pointed out that the charges now in force were fixed in the early part of 1919, at very small advances on pre-war charges, and were by no means adequate to cover the heavy cost of material and labour which the Company had to meet. They had been losing money on the contract. The Council decided that they could not entertain the Company's new estimate; and the officials were instructed to consider the provision of temporary lighting until electricity can be installed.

Storage at Padiham.—The Padiham District Council are in the position that their gas storage capacity is inadequate. The consumption has been increasing since 1914, when the Engineer made a report showing the need for an additional holder, and stating that on many occasions there had not been an hour's supply of gas at midnight. The position, according to the Chairman of the Gas Committee, is now even worse; for on one or two nights recently there has not been a quarter-of-an-hour's supply. The Council, in his opinion, cannot face another winter with the present storage capacity. They must have a new gasholder, which would mean a big extra capital charge; but the increased storage would enable them to economize in the cost of gas making.

Haywards Heath Council and the Gas Company.—Originally there was some suggestion that the Haywards Heath Urban District Council should oppose an application made to the Board of Trade by the Gas Company for a Gas Regulation Act Order; but at the last meeting the Clerk reported that the Committee appointed to consider the matter now advised the Council to withdraw their opposition. Mr. Pannett said it had been pointed out that if the Council proceeded it might involve the Company in considerable injury and loss. They went into the therm charge, and had some eighty decisions by the Board of Trade before them; the effect of it all being that Haywards Heath stood in about the same position as other places. They came to the conclusion that, while they could do no one any good by opposition, they might do the Company considerable harm. Mr. Peache explained that if the Council opposed the Company's application it might delay a settlement for a long time; but if they did not, it would go in the unopposed list, and a decision would be given before or shortly after Christmas. As to the charge per therm, the Board of Trade would probably keep it down to a reasonable maximum. The Committee's action was approved.

Burnley's New Works.—The question of the new works at Old Hall was mentioned at last Wednesday's meeting of the Burnley Town Council. The Gas Engineer (Mr. J. P. Leather), it was stated, had submitted a report on the future requirements of the department, with regard to additional storage and new plant for the new works, and suggested that application be made for sanction to borrow the money required for the purpose. The consideration of the matter was deferred for a month; but, subject to the approval of the Finance Committee, the Town Clerk was instructed to complete the purchase of the site for the new gas-works at an early date. It was also decided to proceed with the construction of the approach road to the site when the purchase had been completed. The Finance Committee, it was reported, had deferred consideration of the matter until they are furnished with a complete report.

Stafford Gas Finances.—Alderman Young, in moving the adoption of the Gas Committee's report at last week's meeting of the Stafford Town Council, said he was hoping that at the end of the financial year they would be able to take 6d. per 1000 c.ft. off the price of gas. The extra outlay on coal during the strike cost the Corporation upwards of £6000, and the price of residuals had dropped by over £3000; so it would, perhaps, be realized what were the difficulties the Committee had had to contend with. Mr. Hindle offered a little friendly criticism. It was, he said, all very well for the Chairman to say the coal dispute had cost so much; but the trouble in the past had been that there had never been an adequate reserve behind the Gas Department to meet such a contingency as this. The best way to manage the undertaking was to try and supply the gas as cheaply and as efficiently as possible to the consumers. The report was adopted.

Keighley's Electricity Breakdowns.—Keighley people have noted with mixed feelings the success of the Corporation Gas Department, illustrated in a constancy of supply and the recent annual financial statement showing a net profit of £1898, when they bear in mind the loss on the electricity and tramways departments and the constant breakdown of the electricity supply. Indeed, the townspeople are beginning to get rather desperate over the repeated breakdowns in electricity. Despite the many occurrences of recent months, followed by measures to secure a more reliable service, consequent on a Government inquiry at Bingley into the complaints of that town against Keighley's electricity supply, yet another breakdown occurred at the end of November, and threw the Skipton Road district—worth noting in view of Keighley's hopes of supplying Skipton with electricity—into darkness, except where gas was the usual illuminant. A picture house, which lost half its first nightly show and all the second "house," was particularly unfortunate in having suffered stoppage from electricity breakdowns three times within a month. It is now stated in the town that the picture house proprietors generally are preparing to lay-down generating plant of their own. The ordinary public, apparently, have to go on suffering—especially as electric lighting is insisted on in the construction of new housing colonies.

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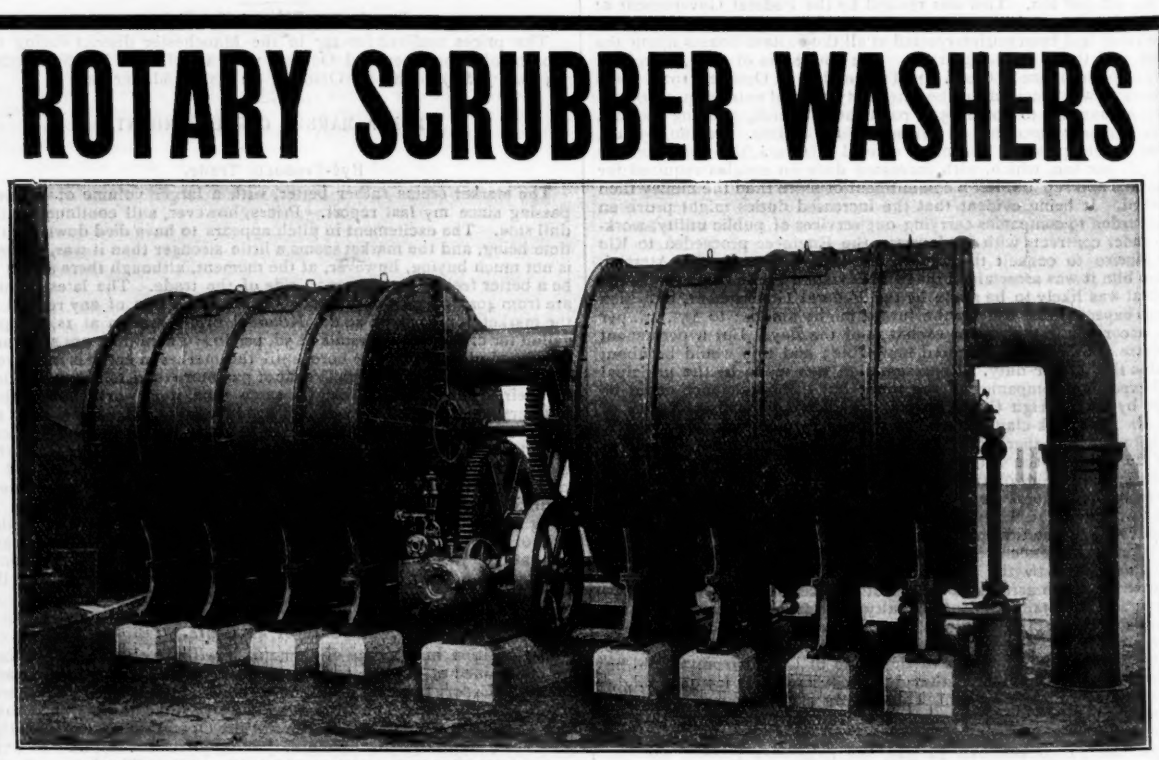

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Nottingham's Inadequate Lighting.

Complaints have been general in Nottingham of late regarding the entirely inadequate lighting of public thoroughfares; and those who again brought the matter under consideration, at the last meeting of the Council, described the present condition of things as representing something in the nature of a scandal. Irritation resulting from unwonted delay in the return to normal conditions has become widespread; the only attempted palliation upon the part of the responsible committee bearing relation to the necessarily heavy expense involved. In no respect does the present lack of a comprehensive system of illumination in Nottingham call for greater need of amendment than in regard to the standardizing of the types of lamps in use; this being a point which has been more than once urged upon the authorities, but with only a modicum of success. At the recent meeting, Mr. E. Kidd submitted a resolution which received very general support, instructing the Gas Committee forthwith to resume the lighting of public lamps to the full extent of pre-war times. The criticism which was advanced by Mr. H. G. Ford (the Vice-Chairman), in the absence through illness of the Chairman of the Committee (Alderman A. Ball), was that the proposal would involve an expenditure of £8500 between now and the end of the financial year, including £4365 for the purchase and erection of 750 standards to replace those which had been worn-out. Alderman Ball had written suggesting that it would be a great mistake to alter the arrangements this year, and advocating that in the next municipal budget a more liberal allowance should be made for street lighting in Nottingham, which had always been looked upon as a badly lighted city. The Vice-Chairman promised that, of the 1300 lamps now unlighted, the Committee would at once light 600 at an additional cost of £2000; and he moved as an amendment that this should be done. The amendment was, however, rejected, and the resolution carried.

Cheaper Gas at Rotherham.—On the recommendation of the Gas Committee, it has been decided by the Rotherham Borough Council to reduce the price of gas to all consumers by 6d. per 1000 c.ft., as from the present month. Alderman Bingham said the Committee went thoroughly into this question; and though the gas accounts showed a deficit between last half year and this of something like £3000 they had taken into consideration the probability of a reduction in the price of coal and in wages, and felt they would be able to carry on economically, if they brought down the price to the consumer.

Warrington Gas Accounts.—The Auditor's report on the Warrington Corporation accounts for the year ended March 31 states that the gross profit on the gas undertaking was £11,066, which was added to the surplus of £16,378 brought forward, together with a sum of £1104 for income-tax rebate, and £663 excess provision for discounts. The charges against these amounts for loan services and bank and deposit interest amounted to £8379, leaving a surplus of £20,833 to carry forward. Sundry income on the gas reserve fund amounted to £82. There were no withdrawals; and the amount remaining in the fund at the end of the year was £2456.

Cost of Gas-Mains for Housing Schemes.—The Housing Committee reported to the Wednesbury Town Council that they were experiencing great difficulty with the extension of the gas-main to the Manor Farm site. The total cost of laying the main was estimated at £1565; and the Birmingham Corporation required interest at the rate of 6 p.ct. per annum until a yearly consumption of 3,760,000 c.ft. for the houses on the site had been reached. Alderman Pritchard (the Chairman of the Committee) said the Council sympathized with the tenants in being unable to have the gas; but they could be assured the Town Clerk was doing his best to get the matter satisfactorily arranged.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Dec. 7.]

Nos. 31,745 to 32,505.

BENSON, S. F.—"Device for measuring flow of steam, gas, air, &c." No. 31,885.
BEZENCENET, M. STEINMAN-.—"Gas-producers." No. 32,351.
BONNARD, L. H.—"Retorts and furnaces." No. 32,481.
COCKEY & SONS, LTD., E.—"Apparatus for washing and scrubbing gases." No. 32,494.
COOK, N. G.—"Machines for discharging and charging furnaces, &c." No. 32,036
DITTRICH, L.—"Flue for portable gas-oven." No. 31,922.
DORMAN & CO., LTD.—"Flexible-jointed pipes." No. 31 975.
FOWLER, C. H. and FOWLER & CO. (LEEDS), LTD., J.—"Excavating or trenching implements." No. 31.819.
FRANK, F.—"Treatment of carbonaceous, &c., materials." No. 31,989.
GIBBONS BROS., LTD.—See Cook. No. 32,036.
HARRISON, J. F.—See Cockey. No. 32,494.
HILLER, H. K.—See Cockey. No. 32,494.
HYATT, J.—"Taps, stop-cocks, &c." No, 32,209.
KEITH, G., and KEITH & BLACKMAN COMPANY, LTD., J.—"Safety cut-out device for heating, drying, &c., apparatus." No. 32,328.
KEITH, G., and KEITH & BLACKMAN COMPANY, LTD.—"Gas-burners." No. 32.417.
MARSH, A. J.—"Folding gas-cooker." No. 32,320.
MATHER, B.—"Gas, &c., heaters." No. 32,184.
PILKINGTON, W.—"Smoke shades for gas pendants." No. 32,041.
ROBERTS, S.—See Dorman. No. 31,975.
STEED, O. H. G.—See Dorman. No. 31,975.
SULMAN, H. L.—"Apparatus for separating from gases finely-divided solids suspended therein." No. 32,200.
TREDLE, W. T.—See Dittrich. No 31,922.
WEYMAN, G.—"Neutralization and drying of sulphate of ammonia." No. 32 216.

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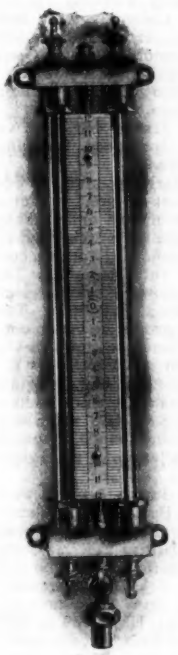

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Barry Extension Proposals.—A crowded meeting under the auspices of the local Ratepayers' and Property Owners' Association was held at Barry last Wednesday, to discuss the proposal of the Urban District Council to expend £125,000 on the extension and improvement of the gas-works. At the invitation of the Association Mr. W. A. Chamen, the General Manager of the South Wales Electrical Power Company, Ltd, addressed the meeting. He stated that £60,000 would be sufficient to give a fair supply of electricity to the town, and a cable could be laid from Barry to Llandaff for an additional £25,000. He contended that electric lighting would be considerably cheaper for the town than gas. A resolution was passed unanimously calling upon the Council to stay its hand before spending such a large sum of money on the gas undertaking, pending advice upon estimates for electric lighting. Mr. C. B. Griffiths (the Chairman of the Gas and Water Committee) challenged Mr. Chamen to meet him on the platform of the biggest hall in Barry, to debate the merits of gas *v.* electricity.

Leek Gas Prices.—The price of gas was discussed at a meeting of the Leek (Staffordshire) Urban Council. Mr. Ratcliffe inquired if the Gas Committee had compared the price with that charged by other towns. The Gas Engineer (Mr. R. H. Ginman) gave particulars of 24 undertakings similar to Leek whose average price was 4s. 11½d. per 1000 c.ft. Taking the last seven years, the average price was 3s. 5½d. per 1000 c.ft. At the present time, the price of gas at Leek was 4s. 10d. per 1000 c.ft., and the average price there for the last seven years worked out at 2s. 9½d. per 1000 c.ft. He pointed out that coal last July cost the Council 44s. per ton; but there were no running contracts, and it was now bought at 36s. per ton in spot lots. Regarding the future, he had every confidence that the price would remain as at present. Then wages in connection with the gas undertaking were practically three times as much as they had been in pre-war times; and it was only quite recently that the first reduction had been made.

STOCK MARKET REPORT.

THINGS on the Stock Exchange were better last week—a condition attributed by some to the (so-called) Irish agreement. Anyhow, several markets were more cheerful, and managed to maintain their buoyancy to the close. In the gilt-edged department, Home Governments were firm—War Loan notably so. Friday's figures for the four being: Consols 48⅞-49¼, War Loan 90-90 9/16, Funding 73 5/8-74 1/4, Victory 79¼ 79¾. New Colonials were firm, and Indians rose further. Home Rails rallied, but encountered profit-snatching later. Canadians recovered; but Argentine were dull.

The Foreign Market showed strength, more especially towards the close.

In the Miscellaneous Market, Rubber was fair, and Oil improved. Insurance, Shipping, and Textiles were supported.

Business in the Gas Market was scarcely on a par with that of the week before in point of volume; several of the minor undertakings being either wholly neglected or very lightly touched. But the buoyancy of prices continued nevertheless in full strength. The London companies showed well in this respect, although quotations varied but little. The Suburban and Provincial group, however, continued their remarkable career of advances—viz., Alliance and Dublin 2, Brentford "A" and "B" 1 each, Brighton and Hove original 8, ditto ordinary 7, British 1, South Metropolitan debentures, South Suburban, and South Shields 1 each. In the Continentals, Imperial rallied, and closed at an advance of 2. Primitivas were neglected.

Bargains done for cash during the week were as follows: On Monday, Bombay 3⅛, Bournemouth 8 5/16, 8 11/32, Brentford "A" 74, Brighton and Hove original 128½, British 23⅝, 24, Commercial 3½ p.ct. 54½, Continental Union 20, European 6½, 6⅝, 6 15/16, 6 7/8, 6 15/16, Gas Light ordinary 64¼ 64½, 64⅝, 64⅝, ditto maximum 49, ditto preference 62, 62½, 63, Hornsey 104, Imperial Continental 134 (and ditto "exceptional" 100), South Metropolitan 69¾, 70, 70½, ditto 6½ p.ct. debenture 103⅜. On Tuesday, Alliance and Dublin 50½, Commercial 3½ p.ct. 54, 56½, European 6⅝, Gas Light ordinary 64¼, 64⅜, 64⅝, 64⅞, ditto maximum 48, 48⅛, 48⅜, 49, Hornsey 103, Imperial Continental 134, 135, 135½, 136 (and ditto "exceptional" 112½), Oriental 87⅛, Tottenham "B" 57½, 57⅝, ditto 6 p.ct. mortgage 92, 92½. On Wednesday, Bombay 3¼, Brentford "B" 74¼, 74⅜, British 23 11/16, Commercial 4 p.ct. 57½, 58½, Gas Light ordinary 64, 65, ditto maximum 48½, ditto preference 62, 62½, 62⅝, Imperial Continental 134, 134⅜, 135, 135½, Primitiva 12s. 3d., South Metropolitan 69⅜, 70, 70⅜, ditto debenture 49⅜, 49½, 50, 50½, ditto 6½ p.ct. debenture 103½, 104, Colonial ordinary 11s., ditto 7 p.ct. preference 14s. 6d., ditto 5 p.ct. debenture 69½. On Thursday, Brentford "A" 75½. Brighton and Hove original 129½, 130, British 24⅛, Gas Light ordinary 64⅜, 63, 65⅛, 65⅜, ditto maximum 49½, Hastings and St. Leonards 3½ p.ct. 39, Imperial Continental 136, 138, South Metropolitan 70½, 70⅜, 71. On Friday, Alliance and Dublin 50⅝, British 24, Buenos Aires debentures 44, 44½, Gas Light ordinary 64 13/16, 65, 65⅛, 65⅛, 65⅜, ditto preference 61½, Imperial Continental 137, 137½, 138, 139, 139½, South Metropolitan 70½, 71, 71½, ditto 6½ p.ct. debenture 103⅜, 103⅝, Tottenham "A" 67½.

In the Money Market, complete ease ruled continuously throughout the week, culminating to its highest degree at the close, when the supply vastly exceeded all possible demand. Discount rates corresponded. Silver marked down to 35½d. at the close. The Bank rate is 5 p.ct., as fixed on Nov. 3.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issues.	Share.	When ex-Dividend.	Ante-War Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices, July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
£			p.c.					
182,049	Stk.	Aug. 26	4	4%	Aldershot 4 p.c. Pref. .	...	30—35	..
1,551,868	,,	Oct. 13	2½	3 1/2%	Alliance & Dublin Ord.	59—64	50—53	50½—50½
574,000	,,	July 14	4	4%	Do. 4 p.c. Deb.	76—79	46—51	
280,000	5	Nov. 30	7½	4/-	Bombay, Ltd. . . .	5½—6½	2 15/16—3⅛*	3⅛—3⅛
100,000	5	Aug. 11	16	4/7½	Bournemouth Gas and Water { 5 p.c. . .	...	7⅛—8⅛	...
					{ B 7 p.c. .	15—15½	8⅛—9⅛	
383,110	10	,,	7	7/-	{ Pref. 6 p.c.	13½—14	7⅛—8⅛	8 5/16—8 11/32
115,000	10	,,	6	6/-	{ 4 p.c. Deb.	...	5⅛—5⅝	
162,065	—	June 30	—	4%	Brentford A Consolid. .	261—266	73—76	74—75½
992,045	Stk.	July 15	14	56/-	Do. B New .	204—209	73—76	74½—74⅝
734,920	,,	,,	11	55/-	Do. 5 p.c. Pref. .	109—111	68—72	..
55,000	,,	,,	5	5%	Do. 4 p.c. Deb. .	91—93	57—59	...
221,400	,,	June 15	4	4%	Brighton & Hove Orig. .	208—213	127—132	128½—130
214,775	,,	Aug. 26	11	10½%	Do. A Ord. Stk.	154—159	92—97	...
244,200	,,	,,	8	7½%	Bristol 5 p.c. max. . .	...	...	...
1,287,500	Stk.	July 28	5	5%	British	44—45	23—25	23 15/16—24⅛
530,000	20	Sept. 29	12½	10%	Do. 4 p.c. Deb. Stk.	88—90	55—58	
120,000	Stk.	June 30	4	4%	Buenos Aires 4 p.c. Deb.	85—87	42—45	44—44½
245,771	,,	,,	4	4%	Cape Town & Dis., Ltd.	1½—2½	6½—7½	...
100,000	10	May 27	—	6%	Do. 4½ p.c. Pref. .	4—6	4½—5½	...
100,000	10	Oct. 28	—	4½%	Do. 4½ p.c. Deb. Stk.	70—75	53—58	...
100,000	Stk.	June 30	4½	4½%	Chester 5 p.c. Ord. . .	108—110	...	...
157,150	,,	Feb. 26	5	5%	Commercial 4 p.c. Stk.	106—108	55—60	57½—58½
1,513,280	,,	July 28	5/9/4	42/8	Do. 3½ p.c. do.	103—105	52—57	54—56½
560,000	,,	,,	5½	38/4	Do. 5 p.c. Deb. Stk.	69½—71½	44—47	..
475,000	,,	June 15	5	5%	Continental Union Ltd.	76—79	19—21	20
600,000	,,	Dec. 11	4	—	Do. 7 p.c. Pref.	115—118	35—40	...
200,000	,,	,,	7	—	Croydon A 10 p.c. . .	...	160—165	...
51,600	,,	Aug. 26	15	15%	Croydon B and C 7 p.c.	...	125—130	...
278,400	—	,,	12	12%	Derby Con. Stk. . .	123—125	...	...
492,270	Stk.	—	6	4½%	Do. Deb. Stk. .	102—104	...	...
55,000	,,	—	4	4%	European, Ltd. . . .	17½—18	6½—7	6½—6⅝
1,002,180	10	Jan. 29	10	5/0	Gas { 4 p.c. Ord. . .	98—102	62—66	64—65½
16,298,975	Stk.	Aug. 11	4/27/4	46/8	Light { 3½ p.c. max. .	76—79	47—50	48—49½
2,600,000	,,	,,	3½	35/-	and { 4 p.c. Con. Pref.	96—99	62—63	61½—63
4,062,235	,,	,,	4	4%	Coke { 3 p.c. Con. Deb.	72½—74½	52—53	...
4,674,850	,,	June 15	3	3%	{ 10 p.c. Bonds. .	...	...	...
130,000	,,	Dec. 11	10	10%	Hastings & St. L. 5 p.c.	...	48—50	...
82,500	,,	Sept. 14	5	3½%	Do. 3½ p.c.	87—89	38—40	39
258,740	,,	,,	3½	2½%	Hongkong & China, Ltd.	16½—16¾	5—6	
70,000	10	May 12	11	5%	Hornsey 7 p.c. . . .	...	100—105	103—104
86,600	Stk.	Aug. 26	9	9½%	Ilford A and C . . .	151—154	84—86	...
131,000	,,	July 28	7½	7½%	Do. B	115—118	61—63	...
65,780	,,	,,	6½	5½%	Do. 4 p.c. Deb. . .	92—94	57—59	...
65,500	,,	June 30	4	4%	Imperial Continental .	150—160	137—142	134—139½
1,976,000	,,	Oct. 28	9	5%	Do. 3½ p.c. Deb. Red.	¼—⅝	83—85	...
1,235,000	,,	Aug. 11	3½	3½%	Lea Bridge Ord. 5 p.c. .	119—121	72—74	...
955,242	,,	Mar. 30	6¼	3½%	Liverpool 5 p.c. Ord. { A.	211—213	...	...
1,408,905	,,	Feb. 26	10	37/6	{ B.	146—148	...	...
306,085	,,	June 26	4	4%	De. 4 p.c. Pr. Deb. Stk.	...	...	...
165,746	,,	Aug. 11	17/3/6	6%	Maidstone 5 p.c. . . .	...	54—56	...
63,480	,,	Dec. 30	—	3%	Do. 5 p.c. Deb. .	...	40— 43	...
75,000	5	June 11	6	3%	Malta & Mediterranean	4⅛—4⅜	2—2⅜	...
250,000	100	Oct. 3	4½	4½%	Met. of Melbourne } 4½ p.c. Deb.	99—101	93—100	...
341,920	Stk.	Nov. 30	4	6%	Monte Video, Ltd. . .	11½—12	53—58*	...
1,875,892	,,	July 28	4½	5%	Newcastle & Gatsh'dCon.	98⅜—99½	63—61	...
529,705	,,	June 30	3½	3½%	Do. 3½ p.c. Deb.	82—83	51—52	..
15,000	10	Aug. 26	—	7/6	North Middlesex 10 p.c.	...	12½—13½	...
35,940	10	,,	7/14/0	5/3	,, ,, 7 p.c.	14—15	7½—8½	...
300,000	Stk.	May 12	8	8%	Oriental, Ltd. . . .	117—122	85—90	87½
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd. . . .	7½—7⅝	2—3	...
188,120	Stk.	June 30	—	3½%	Plym'th & Stoneh'se 5 p.c.	...	64—67	...
60,000	50	Aug. 26	15	60/-	Portsea Island, B . .	128—131	64—67	...
100,000	50	,,	12	55/-	Do. C . .	118—121	51—54	...
249,980	5	April 29	8	—	Primitiva Ord. . . .	5½—6	⅛—⅜	12/3
499,960	5	June 26	5	—	Do. 5 p.c. Pref. .	4⅜—5	1 7/8—2 1/16	...
521,600	100	Dec. 1	4	4%	Do. 4 p.c. Deb. .	91—95	64—66*	...
600,000	Stk.	July 28	4	4%	Do. ,, ,, 1911	...	42—45	...
346,198	,,	June 30	4	4%	River Plate 4 p.c. Deb.	85—87	42—45	...
150,000	10	Sept. 29	6	6/-	San Paulo { 6 p.c. Pref.	10½—11	6—6½	...
135,000	50	June 30	5	5%	{ 5 p.c. Deb.	47—49	35—38	...
135,000	Stk.	Aug. 26	10	5%	Sheffield A	223—224	62—64	...
209,984	,,	,,	10	5%	Do. B	222—224	62—64	...
525,500	,,	,,	10	4½%	Do. C	220—222	62—64	...
133,201	Stk.	Sept. 15	4	4%	Shrewsbury 5 p.c. . . .	...	...	...
90,000	10	Oct. 28	9	8%	South African	10½—11½	7—9	...
6,609,895	Stk.	July 28	5/4/0	5%	South Met. Ord. . . .	111—113	69—72	69½—71½
250,000	,,	July 14	—	5%	Do. Red. Pref. .	...	93—95	...
1,893,443	,,	,,	3	3%	Do. 3 p.c. Deb. .	72½—74½	49—51	49½—50½
224,820	,,	Feb. 25	8½	7½%	South Shields Con. Stk.	137—139	89—91	...
1,087,793	,,	Aug. 11	6	5½%	S'th Suburb'n Ord. 5 p.c.	114—116	71—74	...
368,837	,,	June 30	5	5%	Do. 5 p.c. Deb. Stk.	116—118	73—76	...
647,740	,,	Nov. 16	7½	4%	Southampton Ord. . .	99—102	55—58	...
121,375	,,	June 30	4	4%	Do. 4 p.c. Deb. Stk.	...	59—61	...
120,000	,,	Aug. 11	—	6%	Tottenham { A 5 p.c. .	135—138	66—68	67½
782,275	,,	,,	6	4½%	{ B 3½ p.c. .	115—117	56—58	57½—57½
181,255	,,	June 15	4	4%	District { 4 p.c. Deb.	87—89	54—57	...
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	...
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	45—50	...
236,476	Stk.	Aug. 26	5	3½%	Tynemouth 5 p.c. max.	108½—109	64—66	...
30,000	,,	Aug. 11	8½	66/3	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	131—136	78—80	...
255,636	,,	,,	6½	51/3	Do. B 3½ p.c.	129—134	59—61	...
108,075	,,	,,	—	46/4½	Do. C . . .	...	56—58	...
140,865	,,	,,	—	46/4½	New Ordinary	...	57—59	...
352,000	,,	,,	6½	45/-	Wimbledon 5 p.c. . .	117—122	53—55	...
98,000	,,	,,	6½	50/-	Epsom 5 p.c. . . .	121—126	56—58	...
88,416	,,	June 30	3	3%	3 p.c. Deb. Stk. . .	66—69	44—47	...

* Ex Div.

At a special meeting of the Sanquhar Town Council to consider the position of the gas-works, it was decided to call in an expert, and have a report prepared on the state of the works.

Among the limited liability companies incorporated under date Dec. 5 was Victor Blagden & Co., Ltd., Chemical Merchants, of Coronation House, No. 4, Lloyd's Avenue, E.C. The capital is £125,000 in £1 shares.

Quite recently, under instructions from the Ludlow Union Gas Company, Ltd., the Craven Arms Gas-Works were offered for sale as a going concern. The property was withdrawn.

A pamphlet entitled "Hot Water," prepared by Messrs. Ewart and Son, Ltd., of Euston Road, N.W., emphasizes, by the aid of a number of sketches, the many services rendered by their well-known "Califont" heaters.

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